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INFRASTRUCTURE, PRODUCTIVITY, AND ECONOMIC GROWTH

HEARING

BEFORE THE

SUBCOMMITTEE ON
WATER RESOURCES, TRANSPORTATION, AND INFRASTRUCTURE

OF THE

COMMITTEE ON
ENVIRONMENT AND PUBLIC WORKS
UNITED STATES SENATE

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INFRASTRUCTURE, PRODUCTIVITY, AND ECONOMIC GROWTH

TUESDAY, FEBRUARY 5, 1991

U.S. SENATE,
COMMITTEE ON ENVIRONMENT AND PUBLIC WORKS,
SUBCOMMITTEE ON WATER RESOURCES,
TRANSPORTATION, AND INFRASTRUCTURE,
Washington, DC.

The subcommittee met, pursuant to notice, at 10:08 a.m. in room 406, Dirksen Senate Office Building, Hon. Daniel Patrick Moynihan [chairman of the subcommittee] presiding.

Present: Senators Moynihan, Lautenberg, Reid, Lieberman, Durenberger, and Smith.

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

Senator MOYNIHAN. Good morning. We welcome both our distinguished guests and the visitors to our hearing.

This is the first of a series of hearings that the Subcommittee on Water Resources, Transportation, and Infrastructure will be holding this year as we consider the bill generically known as the highway bill and which works on a five-year cycle. We last reenacted the bill in 1987.

At that time, we made clear that this was to be the last bill of the interstate highway program era. That was no small event. It was the largest public works program in history.

I think it is problematic—I don't know. I know Senator Reid and I are going to want to know what Doctor Munnell and Doctor Eberts say. I wrote an article, a long paper, in 1960 on the interstate highway program, the original title of which was "Federal Roads and Urban Chaos." I made the point that, while the interstate was called the interstate, half the funds would be spent in cities, and that we did not know how to put one of these things through a city. I made the point that there were enormous decisions that would allocate land use population patterns in a formidable way and that we that didn't realize this was what we were doing. I think it comes down to that.

The interstate begins in a 1939 report to the Congress from the Roosevelt Administration, which was very much a public works-oriented Administration. I have a very close association with this whole thing because the visual idea comes out of the Futurama Exhibit at the 1939 World Fair in Flushing. The General Motors Corporation put on this great exhibit and you saw these cities of the future and they looked like a chain of Andes Mountains with holes through them. These holes were connected by bridges and actual cars moved around in them. I was a youth in New York City and the subway cost $0.05 and there was a hole in the fence out in Flushing Meadows and coke bottles could be taken away surreptitiously so you'd get your nickel back. So I may have seen the Futurama Exhibit more than anybody else in my generation.

It was a Moses idea, and it was in 1944 that the Congress enacted it. It never took its real initiative, however, until 1955 when President Eisenhower, seeing that it wasn't moving, reached an agreement for a gasoline tax to finance it. Congressman Jim Wright helped with that—one of his first roles. Then we set out to build in 10 years, for $25 billion, this 39,000-mile program. It took us 30 years, which is not bad as these things go, and about $75 billion.

But in the process we did establish that we did not know how to put one of these things through cities. It may be that in the end, when we finally learn—we have the original in Manhattan, for example. We had an interstate highway crossing east-west on Manhattan Island at Canal Street. It would be a Chinese Wall you'd never get across.

We finally got to the point where we learned how to do one well, which was, I think, the Westway. There are a few pieces left.

At the time of the 1960 piece, I quote Paul Ilvasocker, who said of the planning profession that it was a failed profession. If you knew the expectations for this urban design at the beginning of the 20th century, it was a long idea in American life, as witnessed in Washington, D.C. Indeed, it could not resist the impetus of the enormous amounts of money and money to be made that came into this business.

Driven by the automobile industry—what's good for General Motors—and by the construction industry which was created by it, too.

Well, we have finished it. I think in the process of doing it we have destroyed about half of American cities as effective social units. I think they have not survived. I can think of my own State, and I think each of us can think of ours. They'll never come back. We wrecked them. That's the way of the world.

But now we have another era to come about and everyone wants to know what to do. We look to you economists for advice on what we ought to do, but we would, I hope, have some time in our reflections to say how well we did last time. If we had only built half the interstate system, had put one-third of the money into other modes of transportation, would we be a healthier economy and a healthier society today? America's cities are a wreck, and they were wrecked by this program.

Everybody expects us in this committee to want more money and to deplore the fact that the Administration hasn't asked for enough money. I think we could just as well start this hearing by asking if they have asked for too much, especially given the idea that they haven't the slightest idea what to do except to do more of what they have been doing. But that is enough from me.

I'd like to put in a statement for the chairman of the full committee, Senator Burdick, a statement from Senator Warner, and I have a statement of my own I'll put in.

[The statements referred to follow:]

STATEMENT OF HON. QUENTIN N. BURDICK, U.S. SENATOR FROM THE STATE OF NORTH DAKOTA

I am pleased that the Subcommittee is beginning a series of hearings in Washington, DC., focusing today on the relationship between infrastructure investment and economic growth, and leading toward reauthorization of surface transportation hearings on transportation issues—in Idaho, Montana, Minnesota, Florida, and Nevada—and learned of the different priorities in this vast country. The Federal Government must be a strong partner and provide as much assistance and flexibility to States and localities as possible if this nation is to maintain a first-rate transportation system.

As we begin the reauthorization process, I see several important goals. Among them are: maintenance of our existing investment in a national transportation system; higher levels of spending from the Highway Trust Fund; a balanced approach in meeting the needs of rural and urban areas; coordination of transportation initiatives with clean air legislation as enacted last year; more flexibility for States and localities as they decide on highway and/or transit projects; innovations in financing, management, research, and construction; promotion of new technologies; and a stronger emphasis on safety improvements.

I support enactment of comprehensive, multi-year legislation and hope that this can be achieved well ahead of our September 30 deadline. Transportation programs are vital to the States and to our nation as a whole. I look forward to the debate and to reauthorization of highway, highway safety, and transit programs that will meet our Nation's surface transportation needs in the 1990's and into the 21st century.

OPENING STATEMENT OF HON. DANIEL PATRICK MOYNIHAN, U.S. SENATOR FROM THE STATE OF NEW YORK

Today is the first in what will be a series of hearings this year by the Subcommittee on Water Resources, Transportation, and Infrastructure on the reauthorization of the Surface Transportation Act of 1987.

We come to this subject with the knowledge that we have now completed construction of the Interstate Highway System. Some 43,000 miles, it is the largest public works project in the history of the world, totaling some $130 billion in accrued construction costs since 1956, which would measure several hundred billion in today's dollars. An enormous task. It is now done, save for a few miles here and there. We couldn't build another such system today, nor should we want to. We must move on to new modes of transportation and new methods to maaintain what we have. We also ought, in this process, address other needs, particularly those that we call "environmental" infrastructure. Water supply, wastewater, solid waste and such.

Transportation, however, is our priority. And as I have seen the debate on this matter commence, I would note that the issues have not much changed since the early days of the Interstate. I authored a short piece for *The Reporter* in April of 1960 titled, "New Roads and Urban Chaos." Though we now seem to have old roads and certainly no less chaos, the point is much the same: we have acted with little thought. We built the Interstate without a care toward land use or planning. Without thinking a bit about anything but building roads. With regard to the Interstate in that 1960 article I observed, "We may yet impart some sanity and public purpose to this vast enterprise. We may yet establish some equity in paying for the highways and restore some balance between them and other elements of our transportation system. We may even refute Belloc's dictum, 'The general rule in history is that a city have reached its highest point of wealth becomes congested, refuses to accept its only remedy, and passes on from congestion to decay.' But we shall not escape his rule that 'the Road moves and controls all history.' Roads can make or break a nation."

Make or break a nation. A weighty load, indeed. Just how weighty, we will hear from our witnesses.

Our hearing today, follows a series of hearings that the Subcommittee held in 1987 and 1988 on infrastructure needs. In the meantime, we have received the final report of the National Council on Public Works Improvement. We learn that spending on infrastructure as a percentage of GNP fell by 30 percent in the period from 1960 to 1985. Capital spending by more than half. The National Council tells us we must double our capital spending. According to some estimates, and we will want to explore this today, our infrastructure shortfall is now in the range of 2 percent of GNP, or some $100 billion annually. A $100 billion dollar deficit.

Certainly not all of this spending can come from the Federal Government, nor even most of it. But much of it must.

We also learned in past hearings that research and development for public works nearly doesn't exist. Some $100 million per year in Federal support is spent (most of it in the Corps of Engineers) to support near to $400 billion annually in construction. The U.S. construction market is one-third of the world's total, but we are making do with a low-technology effort. No wonder then that Japanese and European firms are not only leaving us without construction markets abroad, but also increasingly winning contracts here at home.

It also seems that existing contract methods do not reward or encourage new technology applications on our highways. Simple low-cost bidding seems to act as a disincentive, when it comes to calculating the value of new technologies that might save money over the life of a project. This ought to be fully examined.

We also must find new ways to finance infrastructure. Current methods are not adequate.

The President's budget proposal contains some important new proposals for surface transportation. We do look forward to hearing from the Administration on them. However, I cannot help but take note that even as the Administration claims credit for increasing highway spending, it seems a rather hollow claim. The proposal does increase spending ever so slightly, then it actually declines in 1993 and 1994. All of the increase is in the final two years of the President's proposal, 1995 and 1996. It seems all fiscal policy changes are in the out years. We are asked to believe that highway spending is going to go up at the same time the Administration is promising a balanced budget. We shall see.

As we set about the work of our reauthorization effort, we hold two hearings this week. The first, today, is on "Infrastructure, Productivity, and Economic Growth," and we will address the very underpinnings of the government role in public works. Why do we build them? What does investment in infrastructure, highways in particular, mean for our economy? What does a dollar spent on highways get us in return? Might that dollar be better spent somewhere else? I believe our witnesses have insight into these questions, the answers to which have broad implications for the Surface Transportation bill. Our second hearing on Thursday will examine demographic trends and what they can tell us about our future infrastructure needs.

I think it fair to say they that are witnesses today are something of pioneers in the field of infrastructure economics, if I might call it that. We have not much studied the economics of infrastructure spending. And we are delighted to have the very best now working on these issues. Dr. David Alan Aschauer is Professor of Economics at Bates College in Lewiston, Maine. Formerly he was an economist with the Federal Reserve Bank of Chicago. Dr. Alicia Munnell is Senior Vice President and Director of Research at the Federal Reserve Bank of Boston. Dr. Randall Eberts is Assistant Vice President with the Federal Reserve Bank of Cleveland.

We look forward to what they will tell us.

STATEMENT OF HON. JOHN W. WARNER, U.S. SENATOR FROM THE COMMONWEALTH OF VIRGINIA

Mr. Chairman and Members of the subcommittee, I am pleased that this subcommittee has begun the initial hearings which will provide the foundation for the discussions relating to the reauthorization of the Surface Transportation Act.

The two hearings scheduled for this week will seek to express the fact that there is growing recognition that traditional tools such as investment in transportation and other public works can once again provide a powerful force for stimulating economic growth and productivity. Private business relies heavily on public infrastructure capital, such as roads, bridges, and airports, to support productive activity. For example, the Interstate Highway System provides truck access to virtually every large and medium sized market and major port in the United States. Therefore, without question, a limited, or inefficient transportation network will act as a drag on overall private economic activity.

Most economists and public officials do agree that investment in infrastructure can pay economic dividends by improving America's competitiveness in the international marketplace. Good highways serve multiple functions, allowing for access to labor and other key inputs, as well as reliable shipment to local, national, and international customers. Investment in our infrastructure leads to new jobs or new business locations, spreading ripple effects throughout the economy. Without good public infrastructure, private business would be a difficult task.

Mr. Chairman, between July 1, 1956, and September 30, 1990, almost $4.5 billion in Federal funds were spent for the construction and reconstruction of the 1,069 mile Interstate System in my State of Virginia; and over $2 billion in Federal funds were used for the construction and reconstruction of other highways and bridges. The Federal Government has also been a partner in the recapitalization and revitalization of transit systems throughout the Commonwealth, spending $350 million during this same period.

The Commonwealth of Virginia, its local governments, and the private sector have dramatically increased their investments in transportation.

Virginia has demonstrated its commitment to providing superior transportation facilities and services through adoption in 1986 of a $10 billion, 10-year program. The program includes new revenue sources for all modes, creation of a multi-modal Transportation Trust Fund, and the use of creative financing methods such as special taxing districts, public/private partnerships and private funding for the construction of transportation facilities.

Now and in the future, Virginia is prepared to meet its transportation responsibilities, but expects the Federal Government to reassume its traditional role in the historical Federal, State and local partnership through the development of a new, expanded national transportation program.

With completion of the original Interstate System, we must shape the new national policy to preserve and improve on the investments of the past and to meet the priority needs of the future.

Senator MOYNIHAN. I'll turn, in order of appearance here, to my good friend and neighbor, Senator Lautenberg.

OPENING STATEMENT OF HON. FRANK R. LAUTENBERG, U.S. SENATOR FROM THE STATE OF NEW JERSEY

Senator LAUTENBERG. Thank you very much, Mr. Chairman.

It is always a pleasure to be with Senator Moynihan. Though our vintage is close—I precede him—we always get wonderful reminders about the history of our country, and particularly our region, when Senator Moynihan brings up Mr. Moses and his plans and what happened with the Long Island Expressway.

Today's hearing, Mr. Chairman, is an important first step in the consideration of reauthorization of the surface transportation program of the country. It is an important assignment. The choice of focus for today's hearing underscores just why that is so.

I have often said that after the big picture issues of war and peace there are few issues so fundamental to our economic well-being as transportation.

Our National economy was shaped by the availability of good transportation. A sound economy—I make that statement a little hesitantly after hearing about the destruction of the cities from our chairman—a sound economy depends on the ability to move people and goods. When that movement slows down, so does the economy. As today's witnesses will attest, the condition of our transportation system directly affects productivity.

Americans spend an estimated two billion hours stuck in traffic each year. The commuter who spends 20 minutes a day tied up in traffic loses 3.5 full days a year of productive time—time that could otherwise be spent at the office or at home with family.

A recent study looked at the economic impacts of increased transportation spending on New Jersey's economy. The findings, Mr. Chairman, were compelling, and I'm sure they are representative of what we'd see around the country. The study found that for every $100 million in highway spending, more than 3,700 jobs were created, and additionally over $42 million in additional economic activity is generated.

While the benefits of increased transportation spending are clear, we should also look at the cost of not making those investments. The equation is simple: when commerce is delayed in traffic, costs increase in the form of wasted fuel, increased labor cost, and wear and tear on vehicles.

Federal Highway Administration studies show how a clear connection between the condition of a road and the cost of doing business over that road relate, and the increased costs are obviously passed on to the consumer.

The cost of not investing in transportation is also clear when we look at the decisions corporate America makes in choosing locations. There is an old axiom that says that the three most important things in a real estate decision are location, location, and location. Well, that obviously relates to transportation. When it comes to corporate real estate and what goes into deciding where a company locates, you might say the three most important factors are transportation, transportation, and transportation.

A study entitled "The Economics of Industrial Real Estate" looked at the major factors influencing corporate locations. Ten of the top thirteen factors involved transportation.

A survey in New Jersey last year, the most densely populated State in the Union, found that 60 percent of the corporate employers in one of our counties, Morris County, say that their employees are routinely delayed by traffic congestion. Thirty-four percent of the employers said that they actually have trouble hiring new employees because of a location with transportation problems. For a State like ours — for any State—such statistics are ominous.

In our region—as the chairman knows—and throughout many areas of the country, our transportation systems are creaking. They are aging and in dire need of attention.

New Jersey has an extensive highway system—over 33,000 miles of roads and 6,000 bridges. That sounds like a lot of capacity for a little State like mine, but it is not enough. We also have 5.4 million licensed drivers and, incredibly, one registered vehicle for each of those 5.4 million people. Again, it is the most densely-populated State in the country. New Jersey's traffic density is 2.5 times that in our neighboring State of Pennsylvania, and almost twice that in the State of New York. Sixty-three percent of our roads are rated in fair or even poor condition. Twenty-nine percent of our bridges are functionally obsolete or structurally deficient. It is not going to be easy to fix them.

Across the country, $100 million will finance an average of 26 highway projects. In New Jersey that same $100 million will fund only 16 projects. I'm sure that our neighboring States face similar costs.

The problems are clearly enormous, and we have to pay more attention to them. The attention must be in the form, as I put before this committee, of additional funds. I have come to that conclusion, Mr. Chairman. They must be targeted more directly at the areas in the greatest need.

But, Mr. Chairman, we cannot look to more construction as the answer. We need to find ways to get more efficient use of the roads and bridges we have in place today.

An important effort in this area is something that we call intelligent vehicle and highway system, or IVHS. As chairman of the Transportation Appropriations Subcommittee, I have worked to provide funds for this emerging field. IVHS covers an array of things from real time advisory systems to warn drivers of delays with information on how to avoid them, to electronic toll collecting, to in-car technology that can help avoid accidents and allow safer operations, to reduce the time it takes to detect accidents and then get them off the road.

Studies have shown that for every 15 minutes of delay in responding to a traffic incident, one hour of severe congestion results. Therefore, reducing the amount of time it takes to detect and respond to incidents can help reduce congestion and avoid its impacts on productivity.

Mr. Chairman, I'm working on legislation to authorize a comprehensive IVHS program. I know of your interest in new and innovative programs. Hopefully we'll work together to make this part of the reauthorization package.

I want to thank you. I look forward to working with you throughout the process. I look forward to the testimony of today's witnesses which I will have to read, Mr. Chairman, because of the Budget Committee and Mr. Donnovan making his pronouncements that may even have an influence on what we do here.

Thank you very much.

Senator MOYNIHAN. Thank you. You sound like you were going 65 miles an hour there.

Senator LAUTENBERG. And I'm opposed to that. I think 55 is very adequate.

[Laughter.]

Senator MOYNIHAN. We have an opportunity after 50 years to think about this subject. When we speak of density and delay. If I could just speak to this paper of 30 years ago, there was an iron rule that the number of automobiles will increase to take up all the space available, so if you add space you'll get more automobiles.

On the efficiency of it all, I was able to say, in 1960, that half the cars in the country were located in a parallelogram between Boston and Milwaukee down to Saint Louis over to Washington and up again. This area would pay half the cost in gasoline taxes, yet one-quarter of the mileage— mileage would be built out in places like Nevada—and that it would shift population enormously, and it has. In one generation half the United States lives on the West Coast. They got there on highways paid for by people in New Jersey.

Let's see if our colleague from Las Vegas can answer that question, or if he chooses to.

Senator REID. Mr. Chairman, what we haven't talked about here today—and we won't, but we should—is a mode of transportation separate and apart from highways.

Senator MOYNIHAN. The MagLev?

Senator REID. Yes.

Senator MOYNIHAN. One thing we did not do in this program was put any effort of any kind into any alternative modes. We just put more roads and more concrete for more Detroit automobiles.

Senator REID. I hope this year, Mr. Chairman, that we can do something to take care of the problem dealing with rights-of-way so that there can be, by the private sector, some money spent on building these MagLev systems if they had some place to put them.

Senator MOYNIHAN. As the Senator knows, the budget proposed by the President has $24 million.

Senator REID. Double what we had gotten before, and that's great. Compare it to the Japanese billion.

Senator MOYNIHAN. This year. Yes.

OPENING STATEMENT OF HON. HARRY REID, U.S. SENATOR FROM THE STATE OF NEVADA

Senator REID. Mr. Chairman, I do really commend you for holding this first in a series of Federal highway program hearings. This hearing and the one on Thursday will give us an overview of the issues that we have to contend with when we reauthorize this Federal highway program.

Today's program focuses on a simple idea that seems to have been forgotten over the past decade, and those are the words of one of the scheduled panelists, who couldn't make it today, Doctor Aschauer, who said,

> The importance of public investment in physical infrastructure to the stimulation of the private sector productivity, profitability, and investment. This idea, once again in vogue, is nothing new.

In fact, George Will pointed out in one of the columns that he wrote last year that when Abraham Lincoln first ran for the Illinois Assembly his number one issue was public funding for infrastructure, so policy may have finally caught up with President Lincoln.

The President's budget proposal released yesterday proposed a radical restructuring in the highway program. I know most of my colleagues on this committee and from the west can't support this proposal. However, the President did also propose increasing spending—up to $20 billion by fiscal year 1996. So for our Government this is a giant step forward. Of course, the trust fund could support a higher level of expenditures now. These funds should be spent on our Nation's highways as they were intended to be, not used to hide the size of the deficit.

But no matter how much we spend and no matter when we spend it, we are really talking about nickels and dimes compared to the Nation's needs. The Federal Highway Administration estimates that bringing roads up to minimum engineering standards could cost as much as $655 billion over the next 20 years. Meanwhile, over the next 10 years the Japanese will spend $3 trillion—and that's dollars, not yen — on infrastructure problems that they are dealing with.

Although arguing over a few billion dollars in the face of this kind of effort may not be a strong effort—in fact, we may be fiddling while Rome burns—the money must be made available.

We have heard Senator Lautenberg give a lot of statistics. Each State can give the same. For example, in Nevada 14 percent of our urban highways and 15 percent of our bridges are deficient; 31 percent of our interstate miles and 41 percent of our urban interstate miles are in poor condition. In 1987, none of our interstate miles were in poor condition. The statistics, as I have indicated, in other States are equally grim.

I look forward to today's hearing. I hope it convinces my colleagues of the need to once again commit this Nation to building and maintaining an adequate public infrastructure.

When I came here going on nine years ago, Mr. Chairman, one of the weekly publication's had a feature story with pictures on the cover about how we could not wait another year to take care of our decaying infrastructure. Well, we've waited another eight years, and it looks like we're going to wait a few more. I think we are going to come to a period in the not too distant future where the infrastructure is just not going to be able to handle the tremendous demand on it. It is getting old, antiquated, and is in a state of disrepair. Highways are only one example of it.

Senator MOYNIHAN. Highways are one example. Thank you, sir.

I just want to say again, however, that we don't want to take a once in a half-century opportunity to look at this program and just say, "Well, the people who will get the money think they need more." That is not an unusual situation around here. I would hope somewhere along the line we'd hear somebody from our Administration talk about the program. It is my personal view that the interstate highway program destroyed the fabric of American urban society and left us with unlivable inner cities and moved new economic activity out of them, leaving behind a dysfunctional urban society. It's the biggest social issue we have. I am quite prepared to say that the single most important element involved was transportation, because transportation defines so much in life.

Not all of it is done badly. In the New York Times this morning there is an article by Andrew Malcolm out of Weathersville, Connecticut, about an extraordinary highway designer, W. Faher Chase, who for $7 a day, boarding with farmers as he went along the way, designed and built the Merrit Parkway. He put down 47,708 wooden stakes to record the precise position of a plant or a bush that was going to go there. He did a beautiful job. To this day it is a work of art. It is a work of art of its kind, and you, sir, are the proud possessor.

OPENING STATEMENT OF HON. JOSEPH I. LIEBERMAN, U.S. SENATOR FROM THE STATE OF CONNECTICUT

Senator LIEBERMAN. A grateful possessor. I thank you for reminding me and all of us of that part of Connecticut heritage. It is a beautiful road and remains so.

I want to thank you. Your introduction leads me to, in some sense, continue the metaphor for the way in which you begin our consideration of the reauthorization of the Highway Act rather than plunging us into drawing lines through the valleys as to where the roads are going to go to take us, if I may say so, up to the mountain top for a while to look out at the valley and to decide where the roads and transportation systems may go so that we have an idea of what we want the valley to look like and what life in the valley will be like after this is all completed.

In the Clean Air Act, which we considered last year, we began to deal with the intersection of transportation and related issues. I think we recognized that solutions—for instance, to our clean air problems—are intimately related to the transportation decisions we make. In that legislation we included provisions to ensure that transportation and air quality are considered together from the beginning of the process.

We also took some modest steps to encourage a reduction in the number of cars on the road and the number of miles those cars travel by instituting or encouraging larger employers to institute ride-sharing programs in some of the areas of our country that have the dirtiest air.

Here again, with the highway legislation, I think we have the opportunity to not only make transportation decisions, but to make decisions about our transportation system that really affect our quality of life. I appreciate very much, Mr. Chairman, that you are beginning by asking some fundamental questions about goals and impact before we plunge into the details of the numbers.

This hearing today I think raises some very interesting and encouraging ideas about the link between infrastructure development and economic growth, which is competitiveness productivity which is so important to all of us.

I gather that Mr. Aschauer could not make it here today and I regret that, but——

Senator MOYNIHAN. He is fog bound in Maine, as against those of us who are fog-bound in Washington.

Senator LIEBERMAN. I'm not going to touch that.

[Laughter.]

Senator LIEBERMAN. In any case, I think his ideas are very provocative and hopeful, but I must say that some of the questions raised by some of the other witnesses about his ideas are also important for us because we need to examine the impact of simply increasing capital expenditures on the transportation system. I think we have to reach some judgments about whether simple, absolute increases in spending on infrastructure all will be good or whether we need to channel them in certain directions and add certain conditions to them.

Last summer we had a witness appear before the committee, Nancy Rutledge Connery of Maine, who was a former Executive Director of the National Council on Public Works. I just want to quote briefly from something she said to us which I think is relevant to our considerations as we begin this process of reauthorizing the Highway Act. She said,

> Spending more money to expand or rebuild infrastructure does not promise cleaner water, safer bridges, or swifter commutes unless we are willing to confront patterns of consumption, land use development, and our stewardship of the existing system.
>
> If we expand our highways to relieve suburban congestion without addressing these other factors, we may simply bring about more commercial and residential sprawl, which wastes infrastructure assets and endangers, for instance, water resources. We need to better understand the collective influence of these structures on

our sense of place, our connection to the environment, and our connection to each other.

How do they affect development and demand for services in surrounding areas? What will our cities and towns look like, and how will they feel to live in as a result of new investment?

I was struck by that comment before arriving this morning. It seems to me that those questions mirror exactly the ones that you have raised, Mr. Chairman. I think in some sense, the testimony that CBO and Mr. Eberts and Ms. Connery earlier gave us may be telling us that we may need to provide much more discretion to local officials to make some of these critical decisions about infrastructure expenditures. We need to encourage those officials to ensure that an individual community receives the best return on the infrastructure investments that I think all of us want to make. That return will be measured by aggregate spending, but also by factors such as the quality of life in communities around this country.

Again, Mr. Chairman, I thank you for the way we are beginning this process. I look forward to going through it with you.

Senator **Moynihan**. I thank you, sir. If you were to look to an example of what you were addressing, Southern California got everything it asked for in the way of automobiles and highways. Now it appears to have no other problem.

Good morning, sir.

Senator **Durenberger**. Good morning, Mr. Chairman. It is a pleasure to be here. I'll pass on a formal statement, if I might.

Senator **Moynihan**. You are very kind. That's very thoughtful of you.

Our newest and most welcome Member, Senator Smith.

OPENING STATEMENT OF HON. BOB SMITH, U.S. SENATOR FROM THE STATE OF NEW HAMPSHIRE

Senator **Smith**. Mr. Chairman, I have an opening statement I'd like entered into the record.

Senator **Moynihan**. So ordered.

[Senator Smith's statement follows:]

Opening Statement of Hon. Bob Smith, U.S. Senator From the State of New Hampshire

Mr. Chairman, I am pleased to have this opportunity to discuss the effect of infrastructure on our Nation's economy. This topic is important, especially given the Committee's plans to renew and strengthen the 1987 Surface Transportation Act in the coming year.

Before we begin, I would like to make three points. The first is obvious: money will not be available for infrastructure construction and maintenance unless we curtail the growing costs of other Federal programs. As a Nation, we will have to make some tough choices before devoting more resources to bridges, airports, highways, and roads.

Second, I want to remind my colleagues that, although infrastructure spending generates many attractive benefits, it also involves heavy, hidden costs. For example, all taxpayers bear the cost of new infrastructure projects, yet only a few benefit directly from the jobs these projects generate. Moreover, many taxpayers—especially those in rural areas—will never utilize the infrastructure projects that they are asked to support. It is important that Congress balance these drawbacks against the benefits of infrastructure spending.

The third and final point I would offer is that infrastructure's greatest value usually derives from its usefulness as a network, not as an economic force in itself. As several Eastern European countries have demonstrated in recent months, infrastructure becomes largely irrelevant to economic growth if a country's political climate, tax policies, and commitment to R&D are hostile or lacking. Likewise, the Japanese example shows us that one need not have a sophisticated infrastructure in place in order to remain competitive on the economic front.

Mr. Chairman, I want to thank you again for scheduling this hearing; I hope that it will help us obtain answers to some pressing questions. At what stage in a country's development does infrastructure become important to economic growth? Ideally, how much of its budget should a country devote to infrastructure? For how long? Where is spending on infrastructure most cost-efficient? (That is, should we emphasize the reconstruction and repair of existing infrastructure projects, or the initiation of new and different projects?) I look forward to hearing from our witnesses on these issues.

Senator MOYNIHAN. That brings us to our distinguished witnesses.

May I make a point? Mr. Robert Peck will be speaking after we hear from Doctor Munnell and Doctor Eberts. Are you listed in any firm sequence here that one of you comes first? Why don't we just let you go first, because you are a vice president or vice governor.

[Laughter.]

Ms. MUNNELL. Mr. Chairman, it's senior vice president.

Senator MOYNIHAN. Senior. And you're still young enough to enjoy that.

[Laughter.]

STATEMENT OF ALICIA H. MUNNELL, SENIOR VICE PRESIDENT AND DIRECTOR OF RESEARCH, FEDERAL RESERVE BANK OF BOSTON

Ms. MUNNELL. I'm delighted to be here. The topic under consideration this morning is important, and I am happy to let you know everything I know on the topic. But, to align expectations with reality, I am not going to try to address all of the complex issues involved in the reauthorization of the highway bill. My assigned task is limited, and that is to look at the impact of infrastructure on productivity. For the most part, when I talk about infrastructure I am going to be talking about it as a lump—it's a big lump—and highways are only a portion of that.

There are two housekeeping items. I definitely am speaking for myself and not for the Federal Reserve System. Secondly, I have a prepared statement which I'd like to enter into the record.

Senator MOYNIHAN. We will do that in both cases. You just proceed as you wish.

Ms. MUNNELL. I believe my colleague is not speaking for the Federal Reserve System, either.

I would like to make four points this morning. The first is that strong evidence is emerging that public capital does have a significant and sizeable impact on private sector output.

Second is the causation question: that is, do high levels of public capital lead to greater private output or does greater private output leads to more public investment? This is a legitimate question, but it is not as serious a question as critics charge.

Third, at this point the empirical studies alone cannot tell us whether public capital is oversupplied or undersupplied, but some other evidence suggests that American taxpayers are willing to pay for more public capital.

Fourth, those who argue that our Federal grant programs incorporate perverse incentives, and that our pricing or lack of pricing of public infrastructure services is less than optimal, are right.

Therefore, we should move toward more rational grant and pricing strategies, as well as consider increased spending on infrastructure. Let me elaborate on these points— particularly on the relationship between infrastructure and productivity, which is the focus of the hearing today.

Infrastructure is huge. It is $2.6 trillion of public capital compared to $4.6 trillion of private capital. Yet, for the most part, economists overlooked it until some recent work by David Aschauer. It is a little alarming, I think, that we as a profession discover huge systems and huge lumps of capital, decade by decade. We, as a profession, discovered the Social Security system in the 1960's. In the 1970's we found labor unions and private pension plans. In the 1980's we discovered $2.6 trillion of public capital. Who knows what we are going to find in the 1990's.

Senator MOYNIHAN. A solution to the deficit.

[Laughter.]

Senator MOYNIHAN. Up until now you've been finding all this capital you didn't know was there.

Ms. MUNNELL. We might find money. Who knows?

In his important 1989 article, David Aschauer looked at the behavior of the National economy over time and identified a strong relationship between output per unit of private capital and the stock of public capital. In a 1990 article, I re-examined the role of public capital at the National level by exploring the relationship between output per worker and the stock of public capital for the period 1948 to 1987. The results were quite consistent with those that Aschauer produced.

The estimated impact of public capital on private sector output and productivity that emerges from both Aschauer's research and my own study is very, very large. I personally do not take the numbers from these national time series studies too seriously, but they are one piece of evidence in an emerging picture of the relationship between productivity and public capital.

In an effort to gather more evidence, I looked at the relationship between public capital and economic activity at the State level. This was really a much more significant undertaking than I had anticipated because there are no capital figures State-by-State for either private or public stocks. Hence, the first step was to construct the basic wealth data for each State, and then these data were used in three separate exercises.

The first, which closely paralleled the work at the National level, was to look at the role of public capital in the production process at the State level. The second exercise looked at the relationship between public capital and private investment. The third exercise explored the relationship between public capital and employment growth.

Taken together, the results of these three exercises indicated that public capital had a positive impact on private sector output, private sector investment, and private sector employment growth. The magnitudes of these impacts are roughly one-half of those found at the National level. But my results are consistent with the results found by other researchers who also looked at State-level activity.

At the metropolitan level, a recent study by Randy Eberts and a colleague found an impact roughly one-half the size of this State impact.

Critics look at all these emerging findings and charge that the range of estimates is wide and that the relationship between public capital and private output makes the empirical linkages fragile, at best. In my view, they are seriously misreading the evidence.

First, in all cases the impact of public capital on private sector output and productivity has been positive and statistically significant. This is really quite amazing, given that so much public capital spending is designed to alleviate environmental problems or enhance the quality of life, and therefore contributes very little to GNP as conventionally measured.

Hence, the big news is that a strong, positive, statistically significant relationship exists between the stock of public capital and private economic activity, and it shows up in study after study after study.

Second, the variation in the estimates shows a systematic and intriguing pattern. To be more specific, the coefficients at each level of government seem to be very similar across studies. The variation occurs as the unit of observation moves from the Nation to the States to cities. As the geographic focus of the studies narrows, the estimated impact of public capital becomes smaller.

The most obvious explanation is that, because of leakages or spillovers, one cannot capture all the payoffs to an infrastructure investment by looking at a small geographic area. This is only a notion, but since similar studies at similar geographic levels produced similar results, it seems that searching for explanations of the differences between groups may be more productive than the critics' current activity of merely dismissing a growing pile of fairly consistent results.

In short, I am convinced that a strong, sizeable, and statistically significant relationship exists between public capital and private sector output.

Let me turn to the most frequent criticism of the studies linking public capital and private economic activity, the issue of causation. While the empirical work documents a consistent relationship between public capital and economic activity, the question remains of what causes what. Common sense would indicate that each causes the other, a little bit. Capital investments, private and public, go hand in hand.

The mutual influence can exist, however, without necessarily tainting the coefficients that emerge from these studies. In an effort to get a handle on this issue, I looked at some equations that examined the average level of output over a period of time as a function of private capital and labor averaged over the same period of time, and the level of public capital at the beginning of the period. This procedure foreclosed the possibility of any feedback of output growth on public capital, yet public capital continued to show a large, positive, statistically significant effect on output.

In short, the direction of causation is a question that should be taken seriously. It is important to know the magnitude of the causal effect in order to gain some idea about the potential impact of infrastructure investment on economic activity. The small exercise that I did certainly does not answer the question or put it to rest, but it suggests that the coefficient on public capital is not seriously tainted by this simultaneity problem.

Senator MOYNIHAN. By the simultaneity problem, do you mean the degree to which an increase in private investment will give off an increase in public, as well as vice versa?

Ms. MUNNELL. Right.

Senator MOYNIHAN. More taxes will produce more public buildings?

Ms. MUNNELL. Exactly right. And the studies only document that these two are related. They do not necessarily show you which way the relation goes.

Senator MOYNIHAN. Causal.

Ms. MUNNELL. So basically I think there is some reason to believe that higher levels of public infrastructure, all else equal, do lead to higher levels of private output.

Now, is public capital undersupplied? Is there too little? The studies to date cannot answer that question. Until we reconcile the variation in the coefficients by the level of Government, it is difficult to draw from the empirical studies any firm conclusion about whether or not public capital is undersupplied. My hunch, however, is that the United States could use more capital to repair roads and bridges, expand existing airports and build new ones, treat wastewater, dispose of trash, and improve the quality of lakes and rivers.

Some work presented by George Peterson of the Urban Institute is really quite interesting in this regard. Peterson finds a very high approval rate on public capital investment referenda put to the public. He suggests that public officials have a fear of rejection, and therefore are reluctant to bring the proposals to the voters; thus one sees a large percentage of proposals being approved and at very high margins. This behavior suggests an undersupply of public capital.

So this willingness of voters to pay for more infrastructure and the gaps in our system suggest that there may be some undersupply, but this result cannot be deduced from the empirical studies.

Even if this country has underinvested in public capital and public capital has a positive impact on economic activity, it does not mean that the United States should blindly double the amount of money it spends on public capital investment, nor does it mean that careful cost/benefit analysis is no longer needed for individual projects. The reason for caution is that those who argue that our Federal grant programs incorporate perverse incentives, and that our pricing of infrastructure services is less than optimal, are correct. They have a very good point.

More efficient pricing and incentives would probably yield more services from the existing stock of public capital—especially in the cases of airports and highways.

Senator REID. Mr. Chairman, could she explain that a little bit further?

Senator MOYNIHAN. Yes, she certainly can. I think what she's saying is that she's dealing with probably the ever- present problem of Government, which seems to allocate free goods; isn't that right?

Ms. MUNNELL. Yes. There are two points. One——

Senator MOYNIHAN. If it's free, then why not have it? But, of course, it is not free. You explain pricing and tell us——

Ms. MUNNELL. But you did a very nice job.

Senator MOYNIHAN. How do we get some pricing? Toll roads will give you pricing, won't they?

Ms. MUNNELL. They do.

Senator MOYNIHAN. True.

Ms. MUNNELL. There was a meeting yesterday at the American Enterprise Institute. Everybody there was very much in favor of user charges. It is hard to argue against user charges, as they ration roads very well. There is the problem of how many toll gates you can have, but I gather major technological advances could make assessing fees easier over time. Solving this problem is not my particular long suit, but——

Senator REID. Nor ours either.

[Laughter.]

Ms. MUNNELL. But there are a couple of things I would like to mention. Cliff Winston and his colleagues at Brookings have written a book that shows that we put too little surface on the roads, and that thicker roads would significantly reduce maintenance costs. Also, we currently finance road travel by the gas tax. That means that truckers try to conserve gasolinee by using smaller, more efficient engines. Smaller engines, however, can pull fewer axles. This encourages transporting a given load on the fewest number of axles, thus, with the greatest weight per axle. Apparently road damage increases dramatically with the weight of each axle, so what we really want are trucks with many axles that spread out the weight evenly. Unfortunately, our incentives are in the opposite direction.

Senator MOYNIHAN. We tax by the number of axles?

Ms. MUNNELL. Yes.

Senator MOYNIHAN. Exactly.

Ms. MUNNELL. Things like that should be fixed. In the grant area, the government offers the States $0.90 on the dollar. The State transportation secretary is looking at one-tenth the cost of a project when he or she is making a decision. That cannot lead to an optimal distribution of public works. Ideally, the Federal Government's share should reflect the spillovers from one community to another. This is a very hard number, I gather, to get at. But there is no way that 90 percent of the benefits of a road in a State spill over to the rest of the Nation.

Senator MOYNIHAN. I made the argument in 1960 that the interstate highway program would become a major source of the financing of the political system, there being so many contractors and so many contracts. I haven't seen anything in the literature on that, but I've been around New York since then, and the incentive is only to spend regardless of return. Has anything been done aboue the degree to which—as was also evident in the mid-1950's—the interstate highway system would put the American railroad system out of business? There was a huge loss of capital in the railroads, was there not? Doctor Eberts seems to agree.

So you've got this investment here, but you lost there. There is that kind of pricing problem when you have seemingly free goods.

Ms. MUNNELL. You have one subsidized extensively, and one flounders.

I want to conclude with two points: one, I am convinced that a relationship exists between the stock of public capital and private sector output. I am not convinced that the magnitude of the impact is as large as some people have said—particularly Aschauer. We need to do a lot more research, but the evidence is mounting that there is a relationship. I think that is interesting. It should not come as a surprise, but many people are rather startled.

The second point is that the critics who question the incentives in the grant proposals and how we tax are correct. I think we want a two-pronged attack on this problem. We should try to get the pricing and the incentives right at the same time that we are considering the total amount that we spend.

The only reason I am here today is to say that I believe that when we do spend, it does have a positive impact on output.

Thank you, Mr. Chairman.

Senator MOYNIHAN. And the economics profession has discovered that?

Ms. MUNNELL. Yes. We're very astute.

Senator MOYNIHAN. You do say something we might come back to in conversation, that economists have suggested a more efficient solution to maximize efficiency would be to return funds to the States in the form of uncapped matching grants with significantly lower matching rates.

Ms. MUNNELL. Right.

Senator MOYNIHAN. That will get a lot of hurrahs in the Governors' meeting today, I am sure. Maybe we can come back to that.

Ms. MUNNELL. I'd be delighted to.

Senator MOYNIHAN. And, Doctor Vice President Eberts, we welcome you, sir.

STATEMENT OF RANDALL W. EBERTS, ASSISTANT VICE PRESIDENT, FEDERAL RESERVE BANK OF CLEVELAND

Mr. EBERTS. Thank you very much.

Mr. Chairman and members of the committee, I am pleased to appear before this subcommittee to testify on the subject of infrastructure, productivity, and economic growth. My remarks focus on the question of whether public infrastructure, particularly surface transportation, induces local economic development. My answer, gleaned from the literature, is a qualified yes.

The qualifications rest on the realization that the linkage between public infrastructure and economic development is a complex one and no one path captures all the effects. I wish to highlight five channels through which infrastructure influences the regional growth process and then briefly mention what the econometric research reveals about the significance of these five linkages.

I identify these various channels because I want to stress the importance of public infrastructure on economic development, not so much by the magnitude of the effects, since I believe many of the effects are relatively small as we measure them, but rather by the pervasiveness of the effects among the various dimensions of the regional growth process.

The first three effects that I want to talk about relate to the supply side of the regional growth process. Through these channels, infrastructure is seen as expanding the region's resource base, which means that it provides the economic foundation for growth, but that it does not necessarily provide the direct stimulus for growth.

First, infrastructure can contribute directly to output as an input in the production process. We have heard about that this morning. Much attention has been given to this channel with the work by David Aschauer and Alicia Munnell at the National level and some of the work that I have done at the metropolitan level.

This work offers a wide range of magnitudes of the effect of public infrastructure on output. The rate of return of the dollar of public investment ranges from 100 percent to 3 percent.

While individuals will continue to debate which rate of return——

Senator MOYNIHAN. Would you want to tell us what you mean by that?

Mr. EBERTS. The 100 percent would be a one-for-one return. A 3 percent return would mean that a 1 percent increase in investment would yield a .03 percent increase in output.

Senator MOYNIHAN. You seem to suggest an inherent range. What is wrong with two to one or negative?

Mr. EBERTS. That happens. There could be——

Senator MOYNIHAN. You said it ranges from 100——

Mr. EBERTS. From 100 percent to 3 percent. Right.

Senator MOYNIHAN. It might range from 500 percent to a negative 40.

Mr. EBERTS. Right. This is sort of the overall effect that we get—100 percent was what David Aschauer got at the National level. I got 3 percent when I looked at all the metropolitan areas that I have considered. So that was the overall——

Senator MOYNIHAN. So the profession still has some——

Mr. EBERTS. There is a range there to work with.

The reason I even mention this range because this is where the debate seems to be focusing, on which one of these rates might be the right one. But I believe that the important point, and the one that I think few of us would dispute, is that public infrastructure is, in general, a productive input in the production process.

Senator MOYNIHAN. I'd like to ask the committee if they could hear what Doctor Eberts has said because we have a once- in-a-half-century opportunity here. What Doctor Eberts has said is that there is evidence that investment in public infrastructure is a productive activity. That's as much as he is prepared to say, the Vice President of the Federal Reserve Bank.

[Laughter.]

Mr. EBERTS. Assistant Vice President.

[Laughter.]

Senator MOYNIHAN. When you get to be senior do you get more confidence like Ms. Munnell and go right out there and say there is some evidence?

[Laughter.]

Senator **Moynihan**. I just want to make that point.

Mr. **Eberts**. Once I have said this, however, I should mention that the propensity of public infrastructure to stimulate regional growth through this channel depends on a region's economic condition and stage of development and the type of infrastructure put in place. In short, infrastructure will have different effects on different regions, a very obvious statement.

I find in my work that public infrastructure has diminishing returns, that is to say, as the stock of public infrastructure expands relative to other inputs such as labor or private capital, the return to public capital falls. In some metropolitan areas that I have studied, diminishing returns are large enough that the marginal effect of public capital on output is even negative.

Senator **Moynihan**. That's what I was asking.

Mr. **Eberts**. Right.

Of these metropolitan areas for which I find negative effects, all but one is an older, northern metropolitan area.

I mention these findings because I believe they represent not the fact that public infrastructure is under-utilized overall in these metropolitan areas, but rather that the changing spacial pattern of economic activity among many northern cities has created a mismatch of the supply of infrastructure services and the demand for these services. As many firms and households leave the inner cities for the suburbs, perfectly adequate infrastructure in the inner city is not being fully utilized, while infrastructure in the suburb may be over-utilized, as evidenced by increased congestion in these particular areas.

The second channel by which infrastructure affects the supply side of the regional growth process is by augmenting the productivity of other inputs in the production process, itself. For example, accessibility of workers to their work place is a growing problem in urban areas. As workers spend more time commuting, they are inclined to work fewer hours, and the hours actually spent on the job may be less productive. For the firm——

Senator **Moynihan**. Isn't there something—you don't mind our interrupting?

Mr. **Eberts**. No.

Senator **Moynihan**. You're telling us things that get our grey matter working.

Haven't there been some studies that the time of the journey to work has been stable for about a century? I am pretty sure. It takes 52 minutes to get to work, and it did in 1880 and it does in 1980.

Senator **Smith**. It wasn't stable when I came to work this morning.

[Laughter.]

Senator **Moynihan**. The distance has widened and so forth, but there has been kind of a constant.

Mr. **Eberts**. That could be true. I know, though, in metropolitan areas it affects different people differently. The inner city residents have difficulty because of the way the infrastructure system is configured in getting to the jobs in the suburbs.

Senator **Moynihan**. It's not meant to go out as much to go in. You're getting a circular pattern altogether.

Mr. EBERTS. Right. So it might be an overall statement, but I think——

Senator MOYNIHAN. Isn't the majority of commuting today suburb-to-suburb? I see a gentleman nodding his head. What is your name, sir? Just tell us for our information.

Mr. LEONARD. I'm Jeremy Leonard, with the Committee for Economic Development.

Senator MOYNIHAN. And you have that information somewhere in CED?

Mr. LEONARD. Yes. There is an article in the Wilson Quarterly.

Senator MOYNIHAN. The Wilson Quarterly?

Mr. LEONARD. I believe it was the winter of 1990–1991.

Senator MOYNIHAN. Thank you.

Mr. EBERTS. In terms of the augmenting of their inputs in the production process, much of the empirical evidence supports this view, particularly with respect to private capital. Public infrastructure has been shown to raise the productivity—that is, the rates of return—of public capital. This means that public infrastructure provides an economic foundation for growth. However, it should be emphasized that, again, coming from the supply side, it does not necessarily provide the direct stimulus for growth. Additional factors must be present in the region for growth to actually occur.

The third supply side channel that I'd like to discuss is the fact that a region's infrastructure may also attract firms and households to the area, which expands the area's resource base and, in this case, actually stimulates regional growth. Studies have shown that the presence of interstate highway systems have a positive and highly significant effect on the location of individual business establishments.

Some of my own work offers evidence that public infrastructure positively affects the number of firm openings in metropolitan areas, where most of the influence actually comes in terms of the opening of small firms rather than large firms.

Various types of infrastructure have also been shown to be important in creating an urban environment that is attractive to households, such as things related to cultural amenities and the like, along with a very efficient transportation system.

Let me move quickly to the demand side of the regional growth process. There are two channels that I'd like to focus on. On the demand side overall public infrastructure can affect economic development by creating demands for the region's product and the region's inputs. The first channel is one related to the construction of public infrastructure. Since the construction of local public infrastructure requires inputs, many of which are supplied locally, expansion of public capital stock increases demand for a region's output. This is the traditional job-creating or income-creating effect of public works activity.

In my work, I have found that a 10 percent increase in public investment expands personal income in metropolitan areas by 11 percent, a small multiplier effect, but still one that is evident. However, these effects from the construction activity are short-lived, lasting no more than a year after construction ends. Furthermore, the construction effect is outweighed by the longer-term supply side effects of public infrastructure as an input in the production process.

The second demand-side channel is the increased demand for public infrastructure as the region's income increases. Some researchers, as Alicia has mentioned, have argued that the direction of causation from infrastructure to output posited by much of the work on this subject really goes in the opposite direction; that is, an increase in output causes an increase in income, which causes an increase in the demand for public investment.

These critics see this reverse effect as negating the evidence that public infrastructure is a productive input into the production process. However, work that I have done shows that even when one takes account of the possibility that an increase in output does cause an increase in public investment, we still find that public infrastructure causes output and is thus a productive input in the production process.

Furthermore, I have looked at this issue of causation in more depth by analyzing the timing of public and private investment in major-metropolitan areas since the early 1900's to the present. I have found that in many metropolitan areas, particularly in the north, public capital formation precedes, and thus in our terms causes, private capital formation, which suggests that public investment has been used as an effective instrument in inducing local economic development.

Let me close by saying that there is growing evidence that public infrastructure induces economic development. As research continues to explore in more detail the linkages between infrastructure and the regional growth process, we find that the effects of infrastructure are multi-faceted. As I mentioned, they are an important input in the production process, they augment the effectiveness of other inputs, they influence the location and decisions of households and firms, and they increase the demand for a region's products.

Of course, all of this research is based on relationships that existed in the past. Since the effects of infrastructure are not universal but vary by the conditions and characteristics of a particular region, it is important in addressing the infrastructure needs of the Nation in the years to come to consider the economic changes and restructuring that will continue to evolve throughout this coming decade.

While I support the position that public infrastructure in general has positive and significant effects on a regional economy, I also stress that the assessment of public infrastructure's effect on regional economic development should be made on a region-by-region and project-by-project basis.

Thank you.

Senator MOYNIHAN. Thank you very much, Doctor.

Now, neither of you go away.

Senator Smith, you haven't had a chance to ask any questions this morning.

Senator SMITH. Thank you, Mr. Chairman. I have just a couple of questions.

In your last comment, Doctor Eberts, you touched on the question of public activity here. Public at what level? Federal? State?

Local? You have not broken that down in either of your testimonies. Could you comment? I realize it depends obviously on an interstate highway, but are you compartmentalizing that highway with a lot of regional and local? Which is the most efficient aspect of public support that you are advocating?

Mr. **Eberts**. In terms of the research I was doing, this is primarily at the metropolitan level. We tried to include all of the capital stock that was put in place, regardless of whether it came from Federal money, State money, or local money. In most instances, Federal money was channeled through State and local governments, which actually spent this money.

Senator **Smith**. Channeled through rather than left there?

Mr. **Eberts**. Right. Yes. We tried to capture all the public infrastructure that was in place to be used by the residents of these metropolitan areas and businesses.

Senator **Smith**. There is a basic unfairness implied here, or certainly present here, in the sense that many—depending on what these projects are in the infrastructure—for example, small rural areas are not going to use the massive projects that might be in the larger cities of the country like L.A., for example. If you live in rural New Hampshire, how often are you going to use the bridge in L.A. or the mass transit in L.A.? The major criticism, I think, in terms of infrastructure, is how much of it is parochial and how much of it is truly national in scope so that all will get some use, or at least a fair and equitable use of this. Just give me a reaction to how you would deal with that.

Mr. **Eberts**. I guess my reaction would be that certainly there are two levels of transportation infrastructure for a city. One is just to get people around inside it, and the second one is to link that city with a network of other cities. I think, as we see more and more, networks are so important for the growth of a particular city. In regional economic growth theory, we find that it is the linkages with other regions that are important conduits of growth. So transportation certainly provides those linkages with other cities.

Even if we go beyond that, the networking of knowledge and information such as telecommunications is also important for the growth of a city.

So there are, in a sense, two levels. One is the networking and linkages, and the second one is just getting people around inside that particular city.

Senator **Smith**. But you have to convince a person who lives anywhere in rural America that it is justifiable to use a portion of his tax dollar to build a subway in Los Angeles. Isn't that an inherent problem with too much focus on the public aspect of—when you say "public" and don't break it down? Do you follow it? Can either of you respond to it?

Ms. **Munnell**. May I just make a comment?

Senator **Smith**. Sure.

Ms. **Munnell**. This goes back, I think, to the comment that I made earlier about the grant's matching rates. Essentially, if roads in a State benefitted only the people in that State and did not help the environment or get food and imports from the coast to the center of the country, I do not think the Federal Government sould pay anything toward the construction or maintenance of those roads. The rationale for Federal Government involvement is that spillover effects result by linking up the network, or for mass transit by improving the environment for the entire country, or by allowing people who live in the Midwest to come to Boston for a vacation.

But you are right. If you could say no one outside of Massachusetts would derive benefits from this particular road, then there would be no justification for Federal participation. So the Federal participation should reflect the extent to which other people benefit.

Senator SMITH. But, in fact, that does happen under the current system. Certainly in the gasoline tax there is that inequity, and there is some——

Senator MOYNIHAN. A redistribution——

Senator SMITH. Right. Some States do not get the share back that they pay in, obviously, just using the gasoline tax as one example. If the gasoline tax, for example, is used for mass transit—which sometimes it is—then I think you divert it away from the original concept of an interstate highway system linking New Hampshire to California with a lot of States in between. I think this is the criticism that I hear, at least from the smaller States, that the balance is weighted too heavily not necessarily to the larger, industrial States as much——

Mr. EBERTS. If I may add, I think also there is the issue of a rising tide of economic activity. If your region, which includes these larger metropolitan areas, is increasing in wealth, or whatever, that might help the outlying areas. So there might be a somewhat removed effect from that rural resident of really being interested in the infrastructure development in that city that serves the entire hinterland that the person might be part of.

Also, I think we found in the Appalachia area that interstate highways or a road system connected individual valleys together to create a market for these people. By connecting people or creating markets by bringing people together through a highway system, there were benefits from that particular activity.

Senator SMITH. Mr. Chairman, one more point, if I may.

Senator MOYNIHAN. Please.

Senator SMITH. You are much more familiar with this than I, as I have read something that you had to say about it, though I'm not sure if I have the term correct, but I think it is MagLev. Is that——

Senator MOYNIHAN. Magnetic levitation.

Senator SMITH. Right. This is the kind of thing that all of us are going to have to deal with as we look into public support for the infrastructure. Do you repair existing highways, existing railroads, existing airports? Or do you look a little bit more futuristically—perhaps a lot more futuristically—at other concepts? I met with a gentleman from New Hampshire who had an idea that through various terminals around the State, you can hook your car onto this system in the middle of the highways and travel without driving it to your destination, and then you move off the system and drive in. Obviously that's going to save a lot of money in terms of wear and tear on the highway; but, on the other hand, if you put all the money into the highway then you never have the new system.

These are the kinds of things that I think we have to wrestle with before we jump off too quickly into repairing everything we have without looking toward the future. Indeed, we may not need a gasoline tax in the next 75 years because we may not be using gasoline. So where are we going to get the revenues?

Senator **MOYNIHAN**. We may not have any.

Senator **SMITH**. We may not have any. Exactly. Just food for thought, Mr. Chairman. You can respond to it if you like. You don't have to.

Mr. **EBERTS**. There's another dimension to that, and I think it is very real in what we have seen in Cleveland. There is an inner-city that is kind of a donut shape around the actual center of the city that once was bustling with economic activity. Now these activities have moved to the suburbs. Although there is enough activity to warrant maintaining and upgrading some of the bridges, there are not that many people to be served by these particular bridges. What priorities do we place on maintaining those bridges versus expanding in the outlying areas? So I think not only anticipating what the future technology might be, but also anticipating what the future land use might be is very important for using our dollars effectively.

Senator **MOYNIHAN**. Thank you.

The interstate highway program was authorized in 1944, wartime. There was to be a depression. Remember, the depression was going to resume immediately when the war was over. It got going in 1946. Nothing happened. One of the keys to the events in 1955 was to name it the "interstate and defense" highway program. The justification was that we needed a road system in which the Army could transport rockets on truck beds and that the clearances would be large enough to transport rockets. That's an item. I thought rockets went that way, but——

[Laughter.]

Senator **MOYNIHAN**. Thank you, Senator.

Senator Lieberman.

Senator **LIEBERMAN**. Thank you, Mr. Chairman.

I have just a few questions. The first one is really a question of definition which perhaps I missed. When we talk about public infrastructure input and its possible effect on private economic output I presume that the public infrastructure input includes both traditional highway bridge building and mass transit investments, correct?

Ms. **MUNNELL**. Yes. The number I referred to, which is public infrastructure in the aggregate, includes highways, mass transit, water and sewer systems, school buildings, post offices, and——

Senator **LIEBERMAN**. It covers the gamut.

Ms. **MUNNELL**. The gamut.

Senator **LIEBERMAN**. My question is whether the work that each of you have done, which I find very impressive, suggests any differences in the private economic output depending on which public infrastructure input we are evaluating. In other words, do highways have a bigger output? Does mass transit have a larger output? Or is it all comparable?

Ms. MUNNELL. I'll start, and then Randy can report on some interesting work he has done.

I looked at the public capital stocks by State and tried to figure out whether States with larger public capital stocks have higher levels of private output. I then broke the data down into highways, water and sewer systems, and other, which is primarily buildings. The results showed that water and sewer were very important, then highways and buildings were far less important, which is what one would suspect.

Senator LIEBERMAN. So water and sewer were the most important?

Ms. MUNNELL. I think so.

Senator LIEBERMAN. Yes.

Ms. MUNNELL. Yes.

Senator LIEBERMAN. How about mass transit?

Ms. MUNNELL. I did not have the information to break out mass transit facilities.

Senator LIEBERMAN. All right. And the definition of buildings would be public buildings, school buildings——

Ms. MUNNELL. Right.

Senator LIEBERMAN. —public office buildings?

Ms. MUNNELL. Right.

Senator LIEBERMAN. Yes.

Ms. MUNNELL. And there were some conservation-type structures in there, and some equipment, also.

Senator MOYNIHAN. If I could point out to my friend from Connecticut, it is not for nothing that this subcommittee is called Water Resources, Transportation, and Infrastructure. Water comes first.

Senator LIEBERMAN. Yes. That's impressive. I agree.

Doctor Eberts, do you have anything to add to that?

Mr. EBERTS. There have been studies, too, that have looked at breaking the public infrastructure bundle into various components. We looked at highways and streets as well as water and sewer treatment as two components. We found in our work at the metropolitan level that it was the highways that gave us the most significant effect, with water and sewers after that. But still, they are very important.

Some additional studies have shown that it also depends on what activity you're looking at in terms of the effect that you're looking for.

Senator LIEBERMAN. In terms of the output?

Mr. EBERTS. Right. We find that transportation has a greater effect on manufacturing activities than it might on services, and so there is also this other dimension.

Senator LIEBERMAN. Why would that be?

Mr. EBERTS. In terms of the distribution of the goods, itself. Services basically entail getting people around within the area as opposed to transporting goods.

Senator LIEBERMAN. Yes.

Let me ask a second question again about some of the parameters of your work, Doctor Eberts. You said at one point the 11 percent return, I think, in personal income for the 10 percent of infrastructure input, but that the increase was short-lived for one year.

Do any of your studies show how long the increase in private economic output lasts in return for the public infrastructure input?

Mr. **Eberts**. I'm not sure how long. It is a capital stock, and so as long as it is there and adequately maintained, it will provide benefits. This is the supply side, and so you need some demand for the product, too, in order to generate growth.

Senator **Lieberman**. Yes.

Mr. **Eberts**. The way we look at it is that this public infrastructure provides a comparative advantage for the region in selling and producing their goods. So if that infrastructure stays intact and is maintained at the current technology, then it should be very long-lasting.

Senator **Lieberman**. That's important. So, for instance, if we are measuring in response to water or sewer infrastructure investments, the private economic output increases should continue so long as those water and sewer systems are functioning well. That's a good return. In other words, it is not short-lived. It goes on for some substantial period of time.

I can't resist asking both of you—maybe the answers are obvious from your testimony, but maybe not—just to go from the world of the work that you've done, which is very relevant and very helpful to us, to imagining that you were sitting on this side of the table. Tell us, based on your work and your understanding of the Surface Transportation Act as it exists now, how you would rewrite it as part of this authorization process.

Ms. **Munnell**. He deferred to age there, I think.

Senator **Moynihan**. We'll turn to the senior vice president.

Senator **Lieberman**. All right. Let's start with the senior vice president.

Ms. **Munnell**. I guess I am convinced enough by the critics who are worried about the design of the grant programs and the people who are urging user charges for infrastructure services, that I would focus most of my energies in that direction. I think this information that we bring you today is important and interesting, but you are in the hard position of having to make trade-offs between spending on highways and spending on a lot of other programs. So I think the information we bring you is just one piece that you put into a very complicated puzzle.

Senator **Lieberman**. Doctor Eberts.

Mr. **Eberts**. I think what has happened in the last 35 years with the interstate highway system and everything that has been happening along with that has brought the country to a level of economic development that is on a high plane. I think what we're looking at in the next ten years is some fine-tuning of this particular structure that we have in place. And so I would stress the fact that we are fine-tuning. We're looking at what is happening in one city versus another city and one type of project versus another project. We need to be very sensitive to new technology, sensitive to land use, because I believe we don't have the wide open spaces, of course, that we had in the 1950's—especially within the city boundaries—to put roads side-by-side to accommodate the flows of traffic in a certain way. It is certainly more difficult to find solutions to these problems with diminishing availability of land and tighter financing.

Senator LIEBERMAN. But both of you would say, at a time when our resources are obviously limited, that infrastructure spending is a good investment?

Mr. EBERTS. It is.

Senator LIEBERMAN. We certainly shouldn't cut back on the level of spending.

Mr. EBERTS. We shouldn't let our infrastructure deteriorate. We need to maintain it.

Ms. MUNNELL. And I think we are both convinced there is a private sector payoff——

Senator LIEBERMAN. Right. Thank you.

Ms. MUNNELL. —to public sector spending.

Senator MOYNIHAN. I do think that the response to Senator Lieberman's question was—did I get it right?— that you think that a bit more of a pricing mechanism is in order. Is that what I hear from you?

Ms. MUNNELL. I think you really should look at that closely.

Senator MOYNIHAN. There was nothing more extravagant— and why not? It was 1954. Here are these roads. They are for free. In the upper plains it is not just $0.90 on the dollar, but $0.95. But also there is not any information, I don't suppose, about what we did in the cities, is there, except looking out the car window?

Mr. EBERTS. Well, there is, I think, a body on literature on what effect the placement of highways has had on the spatial pattern of activity within a city.

Senator MOYNIHAN. I think it was a disaster. I guess it's because I said it was going to be. But look at your cities. Look at them then and look at them now. Does anyone want to argue that our cities are healthier social institutions, more viable today than they were 40 years ago? Alicia, would you?

Ms. MUNNELL. No.

Senator MOYNIHAN. Doctor Eberts.

Mr. EBERTS. Well, fortunately, I wasn't here 40 years ago, but——

[Laughter.]

Senator MOYNIHAN. You'll be a senior vice president.

[Laughter.]

Senator MOYNIHAN. That's for sure.

We want to thank you very much. Don't think you can go away and not have us know where you are, because we want to talk to you about this legislation. We have a large responsibility here, and a large opportunity.

We're sorry that your colleague couldn't be with us, but we'll give him a chance another time.

We want to thank you very much, indeed.

Ms. MUNNELL. Our pleasure. Thank you.

Mr. EBERTS. Thank you.

Senator MOYNIHAN. And now we're going to have one final witness, a friend of this committee, Mr. Robert Peck, who was formerly with us. Mr. Peck is a practicing attorney and former staff member of this committee.

You're on the Fine Arts——

Mr. PECK. Yes, sir. The U.S. Fine Arts Commission.

Senator MOYNIHAN. Yes. A member of the U.S. Fine Arts Commission, a city planner, and he is here speaking for himself but in the context of some work that the American Institute of Architects is interested in; isn't that right?

Mr. PECK. Yes, sir.

STATEMENT OF ROBERT PECK, ARENT, FOX KINTNER, PLOTKIN & KAHN, ACCOMPANIED BY IAN SPATZ, THE NATIONAL TRUST FOR HISTORIC PRESERVATION, AND AL EISENBERG, THE AMERICAN INSTITUTE OF ARCHITECTS

Mr. PECK. Senator, thank you for inviting me to come to the first hearing on the highway program.

Senator MOYNIHAN. And we asked you suddenly and without giving you a chance to prepare testimony.

Mr. PECK. That's all right. I'm used to that, Senator.

[Laughter.]

Mr. PECK. I worked for you for a long time.

[Laughter.]

Mr. PECK. Senator, I've been working with a coalition of groups that has been spearheaded by the American Institute of Architects and the National Trust for Historic Preservation, both of which have staff representatives here. If I might, I'd ask that they could come forward so that you can see that I am actually not alone.

Senator MOYNIHAN. Yes, please.

Mr. PECK. It's Mr. Ian Spatz of the National Trust for Historic Preservation, and Al Eisenberg of the American Institute of Architects. We won't all speak, except perhaps to answer questions. We will be brief.

Senator MOYNIHAN. Mr. Spatz, we welcome you. Mr. Eisenberg, we welcome you, as well.

Mr. PECK. Senator, this coalition also has in it the World Wildlife Fund Conservation Foundation, Scenic America, the American Planning Association—sort of the usual suspects. This is a group which has basically taken your 1960 article as it's jumping off point. I wonder if you and the committee wouldn't mind if we could ask that your article, which was called "New Roads and Urban Chaos" be inserted in the hearing record?

Senator MOYNIHAN. We will be happy to do that.

[The article referred to appears on page 53.]

Senator MOYNIHAN. I also have a list of the supporting organizations which our reporter, if he will be so kind, will put in the record at this point.

[The list of supporting organizations follows:]

CREATING LIVABLE COMMUNITIES THROUGH THE SURFACE TRANSPORTATION ASSISTANCE ACT OF 1991

Supporting Organizations:

The American Institute of Architects.
The American Planning Association.
The American Society of Landscape Architects.
The Colorado Environmental Coalition.
The Delaware Valley Clean Air Council.
The Land Trust Alliance.
The National Conference of State Historic Preservation Officers.
The National Trust for Historic Preservation.
Preservation Action.

Rails-to-Trails Conservancy.
Scenic America.
1000 Friends of Florida.
1000 Friends of Oregon.
Vermont Natural Resources Council.
The World Wildlife Fund/The Conservation Foundation.

Mr. **Peck**. Thank you.

Senator, I won't belabor the obvious, nor belabor what many people have already said today. Our point is that the highway program has had mixed results. It has certainly been an engineering achievement. It has certainly done wonderful things for the country. At the same time, we are all aware of problems which it has caused.

One of the things that is noteworthy about your article, thinking back to 1960—and, again, which gives us some inspiration for what we are going to suggest today—is that many of the problems which we have now found with the program were knowable and were known at the time. None of this should surprise us.

You wrote, for example, "It is not true, as is sometimes alleged, that the sponsors of the interstate program ignored the consequences it would have in the cities. They exalted in them. Declared the Clay Report"—General Clay—"We have been able to disperse our factories, our stores, our people, in short, to create a revolution in living habits. Our cities have spread into suburbs dependent on the automobile for their existence." They did what they intended to do.

You said, "This rhapsody startled many of those who have been concerned with the future of the American city. To undertake a vast program of urban highway construction with no thought for other forms of transportation seemed lunatic."

You continued, "It was clear that locating the metropolitan portions of the interstate system would constitute an unprecedented venture into national planning, yet no planning provisions of any kind were included."

I guess our point, to summarize it, is that there have been problems with meshing highway planning and land use patterns. Highway planning has become a surrogate for land use planning in many communities. It has determined rather than followed sane land use planning, which takes into account economic and social considerations. And it has, as a result,—as you and I know and as Senator Lieberman's city of New Haven, where I was for a few years, knows—destroyed certain communities, walled communities off from each other, in some places taken racially and economically well-integrated communities and then separated them.

Senator **Moynihan**. You go to Hartford and find something not very different.

Mr. **Peck**. Yes, sir. And as you note, unfortunately, the effect is cross-town traffic in mid-town Manhattan is running at about the same pace it ran 100 years ago, and probably less, not to mention the north-south traffic.

Senator **Moynihan**. That's the number I was trying to get. Yes.

Mr. **Peck**. I think it is six miles per hour.

Senator **Moynihan**. It hasn't changed in a century.

Mr. **Peck**. In any event, there is, of course, the paradox which we have all now seen that, as we spread ourselves thin, we face intolerable congestion in our cities and in the suburbs. People thought they were going to escape the cities to live in wonderful green belts. Well, of course, we eventually paved over a good number of the green belts.

It has reminded me of the line from the movie "Field of Dreams," "If you build it, they will come."

[Laughter.]

Mr. **Peck**. That's what has happened with our highways.

Everyone knows some of the other side effects have been an increase in pollution, probably a profligate use of energy, and, as Doctor Eberts mentioned, a strange pattern of infrastructure investment in which, of course, as you spread yourself out, you wind up spending more and more money to extend sewer lines and water lines—and highways, for that matter—to serve fewer and fewer people per square mile or per acre. This doesn't make sense for all sorts of reasons.

In any event, our coalition has suggested a number of initiatives which might be undertaken within the context of any reauthorization of the highway program, whether it is a total recast, as the Administration is apparently proposing, or a simpler reauthorization of the program.

We suggest the following sorts of things, and we think that there is some urgency because the spigot of money has not been turned off. If the problems are knowable today, we can anticipate that the same effects will happen and continue to happen in the future.

So we suggest, under a few broad rubrics, a number of things. One is that there be strengthened State and local planning. In the highway program at the moment, section 134 requires a continuous planning process in certain metropolitan areas. We suggest that there also be a State planning system and that, more to the point, these planning programs deal more with balanced transportation planning; not to ignore highways, but to consider what the overall needs are and to mesh highway and other transportation planning with overall land use intentions and plans; that they be integrated with pollution control efforts; that they also, where there are conservation plans and efforts underway, respect those, too; and that the public have an opportunity to comment on these plans before the Secretary of Transportation signs off on them.

We also suggest that at some place in the highway program we go back to something which isn't altogether new, either, which is the idea of what we used to call beautification. We in our coalition have referred to enhancements, the idea that there are things which you can build along transportation routes or things which you can preserve and rehabilitate along transportation routes which will make the transportation systems more liveable and the areas in which people live more livable.

Finally, we are suggesting that there be a system of scenic and historic highways somewhat like the wild and scenic river system. It has occurred to me that we might want to change the name in the coalition to the Wild and Scenic Highways Program, and then we could add the beltway and Shirley Highway.

[Laughter.]

Mr. **Peck**. But if we have a scenic highways program with routes like the Merritt Parkway, the cross-county parkway in Westchester, the sorts of highways which I think you would want to conserve, make intelligent use of, you can then face up to the hard questions of whether those are to be major commuting routes or something else. I don't know quite what the something else is — something less than a major commuting route, I guess, and a place where people might still think about going out for a pleasant Sunday drive.

Finally, I would say that there is, within the coalition, great support for something—and I say this with trepidation — something to be done about outdoor advertising, because you can't talk about humanizing highways without talking about it. Having said that, the deponent saith no more on that issue.

That's basically it.

Senator **Moynihan**. Wise in the ways of this committee.

Mr. **Peck**. Yes, sir.

We would hope that you and Senator Smith, Senator Lieberman, and the other members of the committee, would endorse these proposals. What we would like to do, following this, is, if possible, to work with your staff to try to come up with some proposals that are more specific.

Senator **Moynihan**. Good. And let me just thank you for getting together as you all have done here.

I'd say to my colleagues and the people in the room that the point that Mr. Peck, Mr. Eisenberg, and Mr. Spatz is making I think is something that I guess I was trying to make 30 years ago. We missed it. This is an urban program. It is called interstate, but half the money is spent in cities. There was no thought to that. The damage is done now. You'll never get Hartford back. You'll never get New Haven back. We'll never get—I could go through nine towns. A place like Syracuse, you just don't take the—at some levels the land purchasing—well, it is a failed profession.

Mr. Eisenberg, are city planners a failed profession? You can say you're an architect. You don't have to.

Mr. **Peck**. May I say, too, that Mr. Eisenberg is also an elected county supervisor in Arlington, so he knows this from various sides.

Senator **Moynihan**. So he has seen the highway, too.

Mr. **Eisenberg**. Arlington is where we do it right.

[Laughter.]

Mr. **Eisenberg**. We work very hard at it, but we are certainly part of the context of this metropolitan area where we all recognize—those of us who have to get to work downtown—the difficulty of even living close to our jobs in many cases.

Not being a city planner, though, I can, however, speak for the architects, who basically have two points to make with this.

One is a question of whether this country will continue to do business as usual in the area of transportation policy or whether we can take advantage of the opportunity, as you describe it, to do what we really need to do to bring people closer to their jobs, closer to recreation, closer to shopping, reduce pollution, and reduce sprawl.

Secondly, while we should continue to be concerned about getting from here to there, we should also be concerned about what happens along the way and the context in which that happens. I think that's really what this is all about.

Senator MOYNIHAN. Mr. Spatz, you are from the National Trust.

Mr. Spatz: Let me say, Senator, that in historic preservation we haven't lost faith in the planners. They have come around a great deal in recent years. In fact, in many States now there are many more efforts towards comprehensive planning that involve transportation, land use, and historic places, and it is a very encouraging trend. We just think the Federal highway program needs to catch up with that trend and provide those planners the input so that they can be involved in transportation location decision-making and not just be involved in the land use side. They can tie the two of them together.

Senator MOYNIHAN. But, before I turn to Senator Smith and Senator Lieberman, can I just say that one thing that this Senator will be looking for is that we not just put in another layer of regulations which make it yet more impossible to do anything in cities. I see you all agreeing.

What you have mostly been able to do in the way of city planning in the last 20 years is to prevent it.

Mr. PECK. And, Senator, that's the problem. As you know, I've been a preservationist who also believes in real estate development. The problem has been that if you don't deal with these issues early on you wind up dealing with people very frustrated at the end of a process, and then find them using—I won't name the programs—certain Federal permits to stop things. It is just not the way it should happen if people consider all these things early on.

Senator MOYNIHAN. I think that is a very powerful statement. In New York City we were going to have something quite extraordinary happen. We were going to get back the Hudson River from the Island of Manhattan, which we lost unhappily to Robert Livingston in 1826 when the steamboat came along and then the piers came along. We lost that. But then the time came when the steamboats left and there wasn't anything there but the old piers that had been built in the 1840's and 1850's and 1860's and a great bit of urban design, I think, the Westway. You don't have to agree, but I happen to think it was a great bit of designing.

Why could we not build it? Because it turned out that if we tore down those piers we would interfere with the spawning grounds of the striped bass. Now, where they spawned before 1840 no one has ever figured out.

[Laughter.]

Senator MOYNIHAN. And so the whole thing went crashing down. But at this point—well, I've made the point. Your point that when these things come, in the absence of any initial effort you just get frustrated and aroused communities, and then they end up preventing anything from happening, and then the whole law suit is token.

Senator.

Senator SMITH. I have no questions, Mr. Chairman. I'll yield my time to Senator Lieberman.

Senator MOYNIHAN. Senator Lieberman.

Senator LIEBERMAN. I'll be brief, Mr. Chairman. I just thank Mr. Peck because I think his statement and this coalition echoes and affirms the very important point that you've been making this morning and have made, of course, before, which is that infrastructure investment dramatically affects land use and community development. I don't think we can say that enough. Historically we know that community development certainly followed the presence of water. Great cities grew up for transportation commercial reasons, as well.

Now we have intervened and changed all that in a dramatic way. We are now at one of those moments when it would be very important for us to stop and look back at this 50-year, very significant experience that our country has had before we go forward, to try to evaluate its impact—as, of course, many have done—and to have that experience guide us as we go forward, not just to do more of the same. I think we all have a feeling that we need more infrastructure investment in this country.

Actually, there is a remarkable, relatively non-partisan consensus growing around Capitol Hill that infrastructure investment is a good idea. You could clearly see it yesterday in the President's budget. I'm sure you're going to see it from the Congressional Democratic majority. But the important point here that you are making and that the chairman has made is that we just can't rush ahead by writing out more checks and let it go at that. We are having a very significant— now, we do want to go ahead, but we ought to go ahead with some sense of the consequences of our action and hopefully trying in some ways to guide it. I think that the work that this coalition is doing will be an important part of that.

I presume, even though I've only been here two years, that there may be some objections to what you are proposing along the way by others who may be part of this process, but it is important to hang in there. I look forward to working with you on it.

Mr. PECK. I might say, Mr. Chairman, two things. One, not everyone will agree with everything we recommend. But we have, in fact, talked to some planners in the Federal Highway Administration who are quite receptive to the idea of better planning and who seem also to think that you can do planning without gumming up the works and without stopping everything. Second, we do think that there is a way to do all of this and satisfy an awful lot of constituencies. The idea is that this is not an anti-highway coalition and certainly not an anti-infrastructure coalition. We are hoping this will work.

Senator MOYNIHAN. The point could be made that, as far as the cities go, either we find a new way to present these proposals or nothing will ever happen because there is always a Federal judge you can find somewhere, as you know.

Could I just make two points in closing?

I'd say to Senator Lieberman that there is a prize. You are right. I think there is one exception, but every major city in America is built on a body of water. There is a prize—I'll figure out what it is—to anybody who can find me a major city in America in which the interstate highway program did not place a wall between the city and that body of water so that you can't get to it. Come forward and you will be rewarded.

The other thing is to say that one of the questions we really have to address, and this is to Senator Smith's point, is: can we think of some uses for the interstate right-of- way in the form of rail or MagLev, or whatever, that are appropriate and useful in this context? Obviously we had testimony here about eight years ago from a group. The Florida Highway Commission came up, and they testified that by the year 2020, which is not far away in transportation planning, it would take 48 lanes of interstate highway to carry traffic from Miami to Orlando. They weren't sure they had room for it.

[Laughter.]

Senator MOYNIHAN. Russell Baker had a column about this in which he used that for the terse BBC announcement of World War II. He said, "One of our States is missing."

[Laughter.]

Senator MOYNIHAN. Now that kind of thinking, that kind of 30-year thinking, I think is appropriate to us.

We've had a good beginning.

I want to thank all of our staff.

I want to say Senator Symms had to be at the Budget Committee.

This is only the beginning. We are not in any rush about this. We are going to start a new era. Let's see if we can't do it well.

Thank you very much, gentlemen. Thank you all.

We thank our reporter.

[Whereupon, at 11:55 a.m. the committee was adjourned, to reconvene at the call of the Chair.]

[Statements and other material submitted for the record follow:]

PREPARED STATEMENT OF ALICIA MUNNELL

Mr. Chairman and members of the committee, thank you for inviting me to appear today. The subject of today's hearings is an important one, particularly in light of the scheduled reauthorization of the Surface Transportation and Uniform Relocation Assistance Act of 1987, and I am pleased to be able to discuss it with you.

The points that I would like to make are as follows: First, strong evidence is emerging that public capital has a significant and sizable effect on private sector output. Second, the causation question—whether high levels of public capital lead to greater private output or whether greater private output leads to more public investment—is a legitimate one, but not as serious a problem as critics charge. Third, at this point, the empirical studies alone cannot tell us whether public capital is over- or undersupplied, but other evidence suggests that the United States has invested too little in public infrastructure in recent decades. Fourth, those who argue that our Federal grant programs incorporate perverse incentives, and that our pricing of infrastructure services is less than optimal, are right. Let me elaborate on these points, and particularly on the relationship between infrastructure and productivity, which is the focus of today's hearings.

I. THE IMPACT OF PUBLIC CAPITAL ON PRIVATE SECTOR OUTPUT

In 1989, public capital amounted to $2.6 trillion, compared to $4.6 trillion in the private sector *(Table 1)*. Even ignoring investments devoted to military purposes, the stock of public capital amounted to $2.0 trillion, or 44 percent of the value of the stock of private capital. Most of the $2.0 trillion of nonmilitary public capital consists of assets owned by State and local governments. Highway and streets account for 38 percent of total State and local wealth, and water and sewer systems for another 16 percent; buildings (primarily schools and hospitals), other structures, and equipment make up the rest *(Table 2)*.

Table 1.—Private and Public Nonresidential Net Capital Stock, 1989

Capital stock	Billions of dollars	Percent of total
Total	7193.2	100
Total Private	4633.0	64
Nonfarm Business	4466.5	62
Farm	166.5	2
Total Public	2560.2	36
Military	509.9	7
Nonmilitary	2050.3	29
Federal	290.0	4
State and Local	1760.3	25

Source: John Musgrave, 1990, "Fixed Reproducible Tangible Wealth in the United States, 1986–89," **Survey of Current Business**, August, pp. 99–102.

The importance of public capital to the private production process should be obvious. The construction of a highway allows a truck driver to avoid circuitous back roads and bring goods to market in much less time. The reduction in required time means that the producer pays the driver lower wages and the truck experiences less wear and tear. Hence, public investment in a highway enables private companies to produce their products at lower total cost. The condition of the highway, however, can be just as important as its existence. A highway in poor condition reduces the productivity of both private capital and labor; the wear and tear on trucks increases and the driver takes longer to make the trip, requiring greater compensation. Similar, although less direct, stories can be told for police and fire stations, garages, mass transit, and other components of public capital.

Table 2.—State and Local Fixed Nonresidential Net Capital Stock by Type of Assets, 1989

Capital stock	Billions of dollars	Percent of total
Highways and Streets	671.3	38
Water and Sewer Systems	275.6	16
Buildings and Other Structures		

Table 2.—State and Local Fixed Nonresidential Net Capital Stock by Type of Assets, 1989—Continued

Capital stock	Billions of dollars	Percent of total
Schools, Hospitals, and Other Buildings	534.2	30
Conservation and Development Structures	30.7	2
Miscellaneous	28.5	7
Equipment	119.9	7
Total	1760.3	100

Source: U.S. Bureau of Economic Analysis, unpublished data.

Not only does public nonmilitary capital consist of inputs essential to private sector output, but the growth of public capital has varied significantly over time and in a fashion consistent with the pattern of productivity growth *(Table 3)*. The stock of non-military public capital grew rapidly in the immediate postwar period when productivity growth was strong, and then increased at a much slower pace in the 1970's and 1980's when productivity growth lagged. This pattern, combined with common sense, would suggest that public capital plays an important role in private sector productivity and growth.

Table 3.—Average Annual Percentage Change in Labor Productivity and Public Capital Stock, Selected Periods, 1948–87

Period	Nonfarm business output per hour	Net nonmilitary public capital stock
1948–89	1.9	2.9
1948–69	2.5	4.1
1969–89	1.2	1.6
1948–60	2.4	3.7
1960–69	2.7	4.7
1969–79	1.2	2.1
1979–89	1.1	1.0
1948–53	3.1	3.2
1953–60	1.9	4.1
1960–69	2.7	4.7
1969–73	2.1	2.8
1973–79	.6	1.6
1979–89	1.1	1.0

Source: U.S. Bureau of Labor Statistics, unpublished data; U.S. Bureau of Economic Analysis, 1987, "Fixed Reproducible Tangible Wealth in the United States 1925–85," and unpublished data.

Despite its enormous magnitude and potential significance, the $2 trillion of public capital had been virtually ignored by the economics profession, until the work of David Aschauer in the late 1980's. (Economists are a funny group; we discovered the social security system in the 1960's, private pension plans and labor unions in the 1970's, $2 trillion of public capital in the 1980's. What's in store for the 1990's?) In his important 1989 article, Aschauer, looking at the behavior of the National economy over time, identified a strong relationship between output per unit of private capital and the stock of public capital. He also found a statistically significant relationship between the level of multifactor productivity and the stock of non-military capital.

In a 1990 article, I reexamined the role of public capital at the national level by exploring the relationship between output per worker and the stock of public capital for the period 1948–87 (Munnell 1990a). The results were quite consistent with those found by Aschauer.

The estimated impact of public capital on private sector output and productivity that emerges from both Aschauer's research and my study is very large. Using estimates from my own equations, a 1 percent increase in public capital would increase output by .34 percent. Given the size of both output and the public capital stock, this implies a marginal productivity of public capital of about 60 percent; that is, a $1 increase in the stock of public capital would yield 60 cents of additional output. The comparable figure for private capital that emerges from these equations is about 30 percent. Taken at face value, these numbers suggest that public capital is dramatically undersupplied and that a major public capital spending initiative would have an enormous payoff in terms of private sector output. I personally do not take these numbers too seriously; they are simply small pieces of an emerging picture.

In an effort to gather more evidence, I looked at the relationship between public capital and economic activity at the State level (Munnell 1990b). This was a significant undertaking because no data were available on the stock of either public or private capital on a State-by-State basis. Hence, the first step was to construct the basic wealth data for each State. These data were then used in three separate exercises. The first, which was parallel to the earlier work with national data, looked at the role of public capital in the production process at the State level. The results indicated that public capital has a significant, positive impact on output at the State level. In other words, States with more public capital, all else equal, had greater levels of private output.

The second exercise looked at the relationship between public and private investment, where two opposing forces are at work. On one hand, public capital enhances the productivity of private capital, raising the rate of return and encouraging more private investment. On the other hand, public capital serves as a substitute for private capital. The estimated equations confirmed both forces, but suggested that, on balance, public capital investment stimulates private investment.

The third exercise explored the relationship between public capital and employment growth using a business location model. Here the average annual percent change in private employment in the State was estimated as a function of variables reflecting the labor market, energy costs, cost of land, market size, tax burden, band public capital stock. The results showed that even after taking all the other factors into consideration, public capital had a positive, statistically significant effect on employment growth.

Taken together, the results of these three exercises indicate that public capital has a positive impact on private sector output, investment, and employment. The magnitudes of these impacts are considerably smaller than those found at the National level, but they are consistent with the numbers found by other researchers looking at State data (Mera 1973, Costa, Ellson and Martin 1987, and Garcia-Mila and McGuire 1991). For example, the elasticity of output with respect to total public capital was around .15, roughly half the size of coefficients based on national data.

At the metropolitan level, one recent study by Eberts and Duffy-Deno (1989) found an elasticity of personal income with respect to public capital of about .08, or roughly half the size of the State estimates.

Critics charge that the wide range of estimates of the relationship between public capital and private sector output make the empirical linkages fragile at best. In my view they are seriously misreading the evidence. First, in all cases the impact of public capital on private sector output and productivity has been positive and statistically significant. This is really quite amazing, given that so much of public capital spending is designed to alleviate environmental problems or enhance the quality of life, and therefore contributes little to national output as conventionally measured. Hence, the big news is that a strong, positive, statistically significant relationship exists between the stock of public capital and private economic activity, and it shows up in study after study after study.

Second, the variation in the estimates shows a systematic and intriguing pattern. To be more specific, the coefficients at each level of government tend to be very similar across studies; the variation occurs as the unit of observation moves from the Nation to States to cities. As the geographic focus of the studies narrows, the estimated impact of public capital becomes smaller. The most obvious explanation is that, because of leakages, one cannot capture all the payoff to an infrastructure investment by looking at a small geographic area. This is only a notion, but since studies at similar geographic levels produce similar results, it seems that searching for explanations of differences between groups may be more productive than merely dismissing a growing pile of fairly consistent results. In short, I am convinced a strong, sizable, and statistically significant relationship exists between public capital and private sector output.

II. THE ISSUE OF CAUSATION

Let me turn to one of the most frequent criticisms of the studies linking public capital and private economic activity. This is the issue of causation. While the empirical work documents a consistent relationship between public capital and economic activity, the question remains whether public capital investment causes more output or whether high levels of output and productivity lead to greater public investment. Common sense would indicate that the answer is probably a little of each; capital investment, private as well as public, goes hand in hand with economic activity. The mutual influence can exist, however, without necessarily tainting the coefficient of public, or for that matter private, capital in estimated production functions. (An example might help. The greater a person's income, the greater her or his investment portfolio; but this dependence does not diminish the contribution of the returns on these investments to future income.)

In an effort to get at the simultaneity issue, I reestimated some equations using the State data but including the value of public capital only at the beginning of the period. This procedure forecloses the possibility of any feedback of output growth on public capital investment. Yet, public capital continued to show a large, positive, statistically significant effect on output.

In short, the issue of the direction of causation is one that should be taken seriously; it is important to know the magnitude of the causal effect in order to gain some idea about the potential impact of infrastructure investment on economic activity. This small exercise certainly does not put the question to rest, but it suggests that the coefficient on public capital is not seriously tainted by the simultaneity problem. In other words, higher levels of public infrastructure, all else equal, probably cause higher levels of private output.

III. IS PUBLIC CAPITAL UNDERSUPPLIED?

The studies to date cannot answer the question, "Is there too little public capital?" Until the variation in coefficients by level of government can be explained and reconciled, it is difficult to draw from the empirical studies any firm conclusion about whether or not public capital is undersupplied. My hunch, however, is that the United States does need more public capital investment to repair roads and bridges, expand existing airports and build some new ones, treat wastewater, dispose of trash, and improve the quality of the Nation's lakes and rivers.

One piece of evidence that seems to support the notion that public capital is undersupplied was presented by George Peterson at a conference on infrastructure sponsored by the Federal Reserve Bank of Boston. Peterson explored voters' preferences for public capital investment as expressed in bond elections and other referenda. If public officials were trying to satisfy the median voter, as theory suggests, they would submit frequent bond proposals for consideration in order to assess voter demand. As a result, bond elections should be closely contested with bond approval rates and margins close to 50 percent. Instead, Peterson found that 80 percent of infrastructure bond proposals were approved between 1984 and 1989, and that the margin exceeded 66 percent on average. This experience suggests (only 25 percent of capital spending passes through the referendum process) an undersupply. But why?

Peterson suggested that, among other reasons, the undersupply might be traced to the "fear of rejection" on the part of public officials. Since the taxpayer revolts of the 1970's and early 1980's, the very act of referendum voting—and the possibility it brings of public repudiation—appears to intimidate officials. Rather than designing proposals to satisfy the median voter, they aim at garnering as large a majority as possible in order to minimize the chance of rejection. As a result, public capital spending proposals are simply not brought to the attention of voters and too little public capital investment is undertaken.

In short, the willingness of voters to pay for more infrastructure spending and the gaps in our transportation and environmental systems suggest to me that public capital may be undersupplied.

IV. INEFFICIENT GRANT AND PRICING POLICIES

The conclusion that this country may have underinvested in public capital and that public capital has a positive impact on economic activity does not mean, however, that the United States should blindly double the amount of money it spends on public capital; nor does it mean that careful cost-benefit analysis is no longer needed for individual projects. The reason for caution is that those who argue that our Federal grant programs incorporate perverse incentives, and that our pricing of infrastructure services is less than optimal, are correct. More efficient pricing and incentives would probably yield more services from the existing stock of public capital, especially in the case of highways and airports.

For example, as Clifford Winston has pointed out, highway construction and repair are currently financed by a tax on fuel that does not accurately reflect the pavement damage and congestion caused by different types of vehicles. Pavement damage increases with weight per axle, and thus users should be charged according to this measure. The current fuel tax provides the opposite incentive; it encourages fuel economy and thus the least number of axles, and the most weight per axle, to transport a given load. Shifting from a tax on the number of axles to one on weight per axle would greatly encourage efficient use of highways.

In the case of Federal grants, the matching rates are probably much higher than can be justified on the basis of interjurisdictional spillovers. This means that many States, paying as little as 10 cents on the dollar for new highways, face artificially low prices for infrastructure investment. At the same time, the current system caps total Federal matching grants to limit use. The result is that the large subsidy provides an enormous windfall to States with high levels of capital spending, while the cap means that at the margin, the Federal Government provides no incentive for States to spend on Federal roads. Economists have suggested a more efficient solution would be to return funds to the States in the form of uncapped matching grants with significantly lower matching rates.

V. CONCLUSION

The conclusion that emerges from the preceding discussion is that we should pursue two tacks simultaneously. On the one hand, the pricing of infrastructure services should be improved. There is no reason that truck taxation should not shift from number of axles to weight per axle. Grant policy already appears to be moving away from very high matching rates; the new policy also appears to encourage maintenance rather than new construction and broader use of user charges. At the same time, spending on public capital should be evaluated carefully to ensure that the most pressing investments are undertaken. The evidence strongly suggests that such public capital investment will also enhance private sector productivity and growth; the magnitude of that enhancement, however, remains an unresolved issue.

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PREPARED STATEMENT OF RANDALL W. EBERTS

Mr. Chairman, I am pleased to appear before this Subcommittee to testify on the subject of infrastructure, productivity, and economic growth. My remarks focus on the question of whether public infrastructure, particularly surface transportation, induces local economic development. The answer, gleaned from the current body of research performed by me and by others appearing before you this morning, is a qualified yes.

The qualifications rest on the understanding that many of the effects of transportation infrastructure, as well as other forms of infrastructure, come through the supply side of the regional growth process rather than the demand side. Consequently, transportation is seen as expanding the region's resource base, which means that it provides the economic foundation for growth but that it does not necessarily provide the direct stimulus for growth. Obviously, construction of an infrastructure project creates jobs and generates economic activity, but this effect is shown to be short-lived and to be small relative to the combined supply-side effects. The primary benefit of public infrastructure investment then is to provide a region with physical capital that provides essential services to businesses and households.

The propensity of public infrastructure to stimulate regional growth depends on a region's economic condition and stage of development. The effect of infrastructure on a lagging region with underutilized resources is very different from its effect on a booming region characterized by tight markets. Moreover, infrastructure improvement may have less of an effect on a highly developed region than the same infrastructure improvement in a less developed rural area.

The ability of public infrastructure to stimulate regional growth also depends on the type of infrastructure and the mix of economic activity within a region. Transportation systems have been shown to have significant effects on agriculture and manufacturing sectors, and to have little effect on services. However, the changing nature of the U.S. economy may alter these relationships, and periodic assessment should be conducted.

The changing industrial, technological, and regional structure of the U.S. economy also poses a challenge for those who plan future infrastructure investment. As population grows, available urban land diminishes, and financing tightens, the call for increased transportation systems must be met by not simply replicating highway networks and widening roadbeds but also with innovative uses of existing facilities, such as peak-load planning and pioneering alternative modes of transportation choices, and with adequately funded maintenance programs. The effectiveness of transportation on economic development increasingly depends on the efficiency of the transportation networks and the extent to which planning of these systems is coordinated with anticipated economic activity.

Therefore, I support the position that public infrastructure in general has positive and significant effects on a regional economy, but I stress that the assessment of public infrastructure's effect on regional economic development should be made on a region-by-region and project-by-project basis.

I. OVERVIEW

The purpose of my remarks is to identify the various channels through which public infrastructure can affect local economic development and to assess the relative magnitude of these effects. Economic development may be broadly defined as increasing economic activity that would yield greater real income for individuals within an area. The linkages between regional economic development and public infrastructure investment are directly related to the regional growth process, which can be conveniently divided into supply and demand effects. Put simply, a region grows because there is increased demand for its products and services and because the region's resources have the potential to expand to meet the greater demand. The availability and quality of resources within a region are directly related to a region's productivity increases and thus are instrumental in giving it a comparative advantage over other regions in producing output at the lowest possible cost.

The supply effects of public infrastructure on regional growth expand a region's productive capabilities in three basic ways. First, infrastructure is treated as a direct input in the production process. Second, infrastructure augments other factors in the production process by creating an environment that allows these inputs to be more productive. Third, infrastructure attracts inputs from other regions and consequently expands the region's resources and thus its aggregate production capabilities.

The demand effects of public infrastructure basically create demand for a region's output. First, since the construction of local public infrastructure requires inputs, many of which are supplied locally, expansion of local public capital stock increases demand for a region's output. Second, as a region's output expands, personal income also increases which in turn raises the demand for public infrastructure. Third, expansion of public capital stock can affect either positively or negatively the demand for private capital and even labor, depending upon the technical relationship between public and private capital and public capital and labor.

The focus of the discussion will be on transportation. However, since some of the empirical evidence, particularly with respect to supply effects, has not examined transportation specifically, results related to total public capital stock will also be included in order to round out the evidence of the various channels through which infrastructure affects regional economic development.

I will address several issues. First, I will briefly highlight recent trends in highway construction. Next, I will discuss various features of transportation that are different from other forms of infrastructure, and their implications for economic development are discussed. Finally, I will summarize the lessons from current research about the various ways in which public infrastructure affects the regional growth process.

II. SPECIAL FEATURES OF TRANSPORTATION AS AN INPUT

Focusing on transportation as a determinant of local economic development introduces several features that distinguish it from the usual treatment of other factors of production. These features raise fundamental questions when assessing infrastructure's stimulative effect on economic development. First, public capital is site-specific. Once highways and bridges are put in place, their use and thus their economic value depends on the economic activities that utilize them, and this depends largely on the level and type of activity located immediately around these facilities. Second, public infrastructure is typically an unpaid factor of production. Although firms pay taxes to finance the construction and maintenance of highways, for example, the payments by a firm are not on a per unit basis and are definitely less than the cost of constructing an additional mile of highway around that particular facility.

Third, public infrastructure is more a necessary condition than a sufficient condition for economic development. While public infrastructure construction can provide local jobs, unless the project is of considerable size and ongoing, sufficient demand to sustain local economic development must come from other sources. Still, the question needs to raised, "Would the investment have occurred without the transportation investment?" Fourth, while the cost of constructing additional highways within a region is shared by all taxpayers, typically taxpayers use only a small portion of the infrastructure they help finance. Consequently, the distribution of benefits of highway (or other transportation facility construction) are not uniformly distributed among taxpayers nor are they distributed according to their share of the costs. Fifth, infrastructure, particularly transportation infrastructure, has the greatest economic value as a network. Within a region, streets and roads link households to other households, firms to other firms, and households to places of work. On a broader scale, highways connect regional markets to other regional markets. Sixth, in assessing the effect of transportation on economic development on a regional basis, it must also be asked whether the development was a new activity or was it really a shift in activity from prior location to new sites served by the highway construction.

III. TRANSPORTATION AND REGIONAL ECONOMIC DEVELOPMENT PROCESS

As mentioned in the introduction, regional growth is influenced by both supply and demand factors. Supply factors expand the production capabilities of the area either by increasing the amount of resources in the region or by enhancing the productivity of existing resources and consequently lowering production costs. Demand factors utilize existing resources, without necessarily expanding the region's production capabilities. Transportation is central to both types of factors. This section will lay out the various channels and show the role of transportation within each channel.

A. SUPPLY FACTORS

1. Direct input in the production process

Output is produced using resources that take the form of labor, private and public capital, and raw and intermediate materials.[1] While output includes both physical goods and intangible services, for expository purposes we will simply describe the process as if goods are the sole output of the production process. If all resources in a region are utilized to their fullest capacity, then a region cannot increase output, even if demand expanded. The region's economic development is thus constrained by a region's finite pool of resources.

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[1] See footnotes at end of statement.

Transportation services are fundamental to a firm's production process. Needless to say, without transportation, the flow of inputs into a plant and the shipment of products out of a plant would not be possible. Moreover, markets could not exist without the physical means of bringing producers and consumers together. An increase in the stock of highways and streets would then increase the quantity of transportation services available to firms.

However, the proportion by which transportation services increase with expansion of the stock of highways and streets depends on the specific conditions of the individual regions, particularly the utilization of the present transportation system and the geographic location of economic activity. For example, if the present system of highways and streets in a region is generally underutilized, then adding to the stock of highways should have little effect on the amount of transportation services available to a firm. On the other hand, if the location of firms changes within a region, adding highways to link these firms with others in the area increases aggregate transportation services within a region, even though the other arteries may still be underutilized. In either case, if the present highway system is overutilized to the extent that congestion commonly occurs, increasing highway stock will expand transportation services within the region and lower the cost of transportation services to individual firms.

Empirical evidence to support the notion of public capital stock as a productive input is based on several estimation techniques and types of datasets. The most important distinction for this discussion is the unit of analysis. Given the effects of specific regional conditions on infrastructure's impact on local economic development, as outlined above, one should be cautions initially about aggregating data to a level that would gloss over regional differences.

In addition, some studies have tried to assess the linkage by setting up a "treatment" group and a "control" group. Many of these studies have found little effect between infrastructure and economic development. However, it is very difficult to set up an analytical experiment in which the two groups are identical except for highway investment. Most of the studies mentioned here "control" by taking into account statistically for the features that are important to the infrastructure-development linkage.

Results from several studies support the notion that public infrastructure, and more specifically, transportation is a productive input in the production of goods and services. I looked at the effect of local public capital stock in the manufacturing production process for 40 metropolitan areas between 1958 to 1978.[2] I found that public capital stock makes a positive and statistically significant contribution to manufacturing output, supporting the concept of public capital stock as a factor of production. In his study, public capital stock includes all components of public infrastructure put in place by State and local governments within the region. The magnitude of the effect of public infrastructure on output is relatively small when compared with the contribution of labor and of private capital to output. A one percent increase in public capital stock increases manufacturing output 0.03 percent. In contrast, a one percent increase in labor (hours worked) increases output 0.66 percent, and a one percent increase in private capital stock increase output 0.32 percent.

Other studies, particularly the time-series studies of David Aschauer and Alicia Munnell, have shown much larger effects.[3] The contrast between results of time-series analysis and those of cross-section analysis is illustrated in Munnell's own work. She found that a one percent increase of public infrastructure increased output 0.34 percent in her time-series study, but by only 0.15 percent in her cross-section study. Aaron (1990), in discussing Aschauer's work, argued that time series data do not vary enough to be given serious consideration, leading to spurious correlation. Tatom (1990) has further pointed out that there are many confounding factors that occur over time, such as oil price shocks and demographic changes, that are not accounted for in these two studies.[4] Tatom found that by including energy prices and first-differencing the time series the effect of public infrastructure on output was no longer statistically significant. While most researchers agree that infrastructure's effect is positive, many are skeptical of the magnitudes reported by Aschauer and Munnell.

Several studies have examined transportation separately when estimating the effect of public capital stock on output. Kevin Duffy-Deno using the data set I developed, found that among the three categories of infrastructure he explored, highways are most important, followed by sewers, and then water.[5] For Munnell, who looked at State-level data, the effect of public capital investments in water and sewer combined was the largest, but highways were close behind. Studies of other countries, in particular Japan, concluded that transportation is a significant contributor to output, particularly in the manufacturing sector.[6] Others have found transportation to be a statistically significant determinant of gross State product, though its importance was less than education.

Helms shows that government expenditures on highways, local schools, and higher education positively and significantly affect State personal income.[7] Some of the strongest effects at the regional level come from a study of the effects of public investment in rural areas by the C0NSAD Research Corporation, which attempted to assess the effect of public works investment on growth of real income in 195 small Missouri municipalities. This study found that public works infrastructure accounted for 30 percent of the gain in real income between 1963 and 1966. Of the major investment projects considered, federal highways, barge docks, vocational schools and recreational facilities contributed the most to income growth.

Although the general consensus is that public infrastructure positively affects output, its effect varies widely among regions, and in some cases the effect is negative. I found a wide variation in the contribution of total public capital to manufacturing output among the 38 metropolitan areas I analyzed.[8] Eleven of the 38 cities experienced negative relationships between public capital stock and manufacturing output. All but one of the negative elasticities was found in older northern cities, where the infrastructure is likely to be more developed and perhaps underutilized as evidenced by the large stock of public capital relative to other factors of production. Another interpretation is that public infrastructure in the northern cities is less effective because it is less well maintained or out-of-date, or because it does not serve the changing spatial arrangement of cities.

Other studies have also reported differential regional effects. Costa and others estimated a negative correlation between several States' public capital output elasticities and their per capita stock of public capital.[9] They find negative effects of public infrastructure on manufacturing in ten States, generally those with high per capita public capital. With respect to transportation, there is some evidence that investment in highways may help stimulate lagging areas. Deno observed that highway capital stock made a significantly larger contribution to manufacturing output in declining regions than in growth regions.

The role of transportation varies not only across regions, but also over time. Within manufacturing, for example, innovations in inventory management, such as the adoption of "just-in-time" techniques and the shift to more customized products, make efficient transportation systems that place a premium on the timeliness of the shipment essential to the productivity of firms and to the comparative advantage of regions. Evidence of this change has been the intermodal switch from water and rail transportation to air and truck shipments.

These innovations have also changed the relative demand for intraregional transportation versus interregional transportation. A study by the U.S. Department of Commerce (1987) argued that with the widespread adoption of computer-integrated flexible manufacturing systems, production will become much more of a local matter.[10] Plants will be able to make a batch of differentiated products almost on demand. These manufacturing centers will have the capability of manufacturing nearly an infinite variety of classes of products. Major cities will tend to become ringed by companies operating these systems, instead of importing the products from other regions. The same study also cites evidence supporting the notion that future economic growth will require less in the way of transportation of heavy industrial raw material per unit of output. This shift from heavier inputs and outputs to lighter high-value products have important implications for the relative use of competing transportation modes. The relentless rise of the service sector will undoubtedly reinforce these trends.

2. Enhancing the productivity of other inputs

Transportation services may have indirect effects on a firm's productivity by enhancing the productivity of other inputs. For example, the accessibility of workers to their workplace is a growing problem in urbanized areas. As workers spend more time commuting, they may be inclined to work fewer hours and the hours actually spent on the job may be less productive because of the energy and aggravation spent getting to and from work. In addition, highway (and mass transit) congestion coupled with poor transportation systems to accommodate commuting patterns limits the pool of workers for some business establishments. For example, several studies have documented the problem faced by poorer households in urban areas in finding convenient public transportation to the service and manufacturing jobs that increasingly locate in suburbs.

The semiconductor industry in the Silicon Valley is a graphic example of the effects of an inefficient transportation system.[11] As housing prices in the northern part of the valley escalated, production workers in the industry, who were typically lower paid than engineers, were forced to find homes further away from the production facilities, commuting longer distances which led in part to greater traffic congestion. The reduction in the labor pool immediately around the plants increased labor costs, and eventually forced much of the production side of the semi-conductor industry to leave the area. An efficient transportation network would probably have helped to hold down labor costs and keep facilities in the region.

The relationship between public infrastructure and other factors of production can also be viewed in terms of how the increased abundance of one factor affects other factors' contributions to output. For instance, if an increase in highways raises the value of private capital in the production process, then the two inputs are considered to be complements. If the opposite effect occurs, then the two inputs are termed substitutes. A finding that public infrastructure and private capital (or labor) are complements would suggest that public infrastructure provides the foundation for economic development, and thus is a necessary condition of regional growth. If public capital and other factors are substitutes, then public and private capital stock are more or less interchangeable, which leads to the question of why the public sector provides a service that could be provided by the private sector.

The empirical results are somewhat conflicting, although there is some support for the notion that infrastructure is complementary to private capital. Most of the evidence is based on estimates of total public capital stock, and few studies provide separate estimates of the transportation component. I found that public and private capital are complements. Similar work by Dalenberg supports this finding.[12] However, Munnell found total public and private capital stock to be substitutes. Moreover, she found that highways are substitutes with private capital, which she justified by explaining that well-maintained roads reduce private investment in vehicles.

I also examined the effect of public infrastructure on regional manufacturing productivity, as measured both by labor productivity and total factor productivity. Using the sample of 36 metropolitan areas, I found a positive, but limited, effect on regional productivity. The effect was statistically significant before 1973, but insignificant afterwards. However, the paper also pointed out that public infrastructure appears to be a major factor in explaining growth rates of inputs.[13]

3. Creating an attractive environment

The previous two channels have considered the effect of public infrastructure on a region's output, holding other inputs constant. However, a region's infrastructure may also be attractive to firms and households, and it consequently may induce additional resources to move into a region. In this case, public infrastructure has its effect on output indirectly through increases in the quantity of labor and private capital, and not because it is directly productive. As additional labor and private capital move into an area, the per unit cost of these inputs falls, giving these firms a competitive advantage over firms outside the region.

Firms find a region with an ample and high quality infrastructure attractive for two reasons. The first is for the reasons noted in the first two sections: public capital is a productive input, and it enhances the productivity of other inputs. The second reason is that in most cases a firm does not pay the full price of using the public capital stock. For example, highways are typically financed by taxes that are levied on households, as well as on firms. Furthermore, the use of highways by households and by firms varies depending upon their location and the type of economic activity they engage in. To the extent that the tax system does not charge the full value they place on the use of the public facility, an individual is subsidized through the shared nature of public infrastructure. Owners of firms, then, extract rents by locating in an area that provides infrastructure at a cost below their valuation of the use of the infrastructure. The same can be said of households. However, as more firms and households move into an area, causing congestion on highways and on other infrastructure facilities, extractable rents are diminished, and existing infrastructure becomes less attractive to firms and households.

The free movement of firms and households within and between regions raises another issue with respect to the effectiveness of infrastructure. While infrastructure may be attractive to firms and households and to some extent it may determine their location, it is also possible that public infrastructure may become underutilized because spatial patterns of firms and households have changed. Consequently, it may appear that an area has sufficient transportation infrastructure when viewed in the aggregate by looking at miles per person or dollars of investment. However, chronic congestion and costly bottlenecks may exist and be observed, when attention is given to smaller geographical grids within a region.

Firm location studies that have included various measures of public infrastructure have found that certain forms of infrastructure are attractive to firms. Some of the strongest results were reported by Fox and Murray, who found that the presence of interstate highway systems had a positive and highly significant effect on the location of individual establishments in the State of Tennessee. Bartik, using a national sample, also found that the number of new branch plants was higher within States with more miles of roads. Some of my work offers evidence that public infrastructure positively affects the number of firm openings in metropolitan areas.[14]

Public infrastructure may also affect the migration decisions of households by enhancing an area's amenities. However, the existing literature related to household location decisions does not focus much on public infrastructure. labor migration studies tend to concentrate primarily on demographic characteristics and wage differentials to explain migration flows. Urban quality-of-life comparisons, which deal with the same underlying decision process, come closer to addressing this issue, but their major focus is on attributes such as air quality, climate, and so forth.

B. DEMAND FACTORS

1. Construction of highways

The construction of highways, particularly when the financing comes from outside the region, directly stimulates the local economy. The effect of a construction boom on residents within an area depends on the extent to which households and firms from the area are employed by the projects. The less the indigenous population takes part in the construction, the smaller the effect of the actual construction on the growth of the area.

A recent study I conducted with Duffy-Deno found that a 10 percent increase in public expenditures for infrastructure construction expands personal income by as much as 11 percent.[15] However, the effect of construction on the local economy is short lived, lasting less than a year after the construction. The study also compared the "construction" effect of public infrastructure with the supply-side productive effects, as described earlier, and found that the effect of public capital as an input has nearly twice the effect on personal income as does public capital as a construction activity. Although highways were not examined separately, there is little reason to expect the qualitative results to be much different.

2. Increased demand for highways

As a region's output increases, resulting from increased construction activity or from other activities, personal income in the region also grows. If highways, and other public infrastructure are considered to be a normal good, for which its demand increases with income, then the demand for highways will rise within the region. The increase in highways will in turn increase the production capabilities of the region, giving it a comparative advantage to other regions, and providing an opportunity for expanded output.

Some researchers have been concerned that the positive relationship estimated between public capital stock and output does not reflect the effect of infrastructure on output but rather the reverse—the effect of output (and indirectly the income generated) on the demand for public infrastructure.

Duffy-Deno and I estimated the two directions of causation simultaneously. One equation described the effect of public infrastructure on metropolitan personal income, and the other equation explained the effect of personal income on public capital investment. Both effects were statistically significant when estimated jointly, which supports the view that public capital does affect regional growth.

Fogarty and I further explored the causal relationships between public investment and private manufacturing investment for each of 40 cities since the beginning of the century.[16] The preponderant effect was for public capital to lead private capital, though in some cases private capital led public capital, particularly among southern cities which tend to be more recently development. We concluded from these results that public investment has been used as an effective instrument in promoting economic development.

3. Effect on public infrastructure on the demand for private capital

In a very simple framework, increased public infrastructure will reduce private capital stock if the two are substitutes and increase the demand for private capital stock if the two are complements, as previously defined. This relationship is complicated by other considerations, such as the responsiveness of output to a rise in demand, the extent of unemployment, and the source of infrastructure finance.[17]

David Aschauer explored the effect of infrastructure on the demand for private capital through financial markets. He posited that the financing of infrastructure investments raises interest rates, because of the excess demand for financial credit. Unless the savings rate is increased commensurately (or taxes raised), the higher interest rates will persist, which will lower private sector investment. Within this conceptual framework, Aschauer found that a $1.00 increase in public investment reduces private investment within a range of $1.00 to $1.50. However, studies reported earlier that find private and public capital stock to be complements would not support the crowding out results of Aschauer.

III. ASSESSMENT AND CONCLUSION

Studies have shown that surface transportation and other types of public infrastructure induce economic development, although these effects vary by regional conditions, and by type of investment. If the various channels were ranked according to their effectiveness in inducing economic development, supply effects would be placed above demand effects. On the supply-side of the regional growth process, it appears that the effect of public infrastructure on output comes more through its effect on labor and private capital inputs, which in turn affects output, than directly as an input into the production process.

By focusing only at the local level, one may be inclined to ask whether infrastructure investment is simply rearranging a fixed pool of resources, benefiting those regions that have attractive infrastructure investment at the direct expense of other regions. However, the positive effects observed at the national level allays these concerns to some extent.

The United States is faced with the monumental task of replacing and upgrading their present public capital stock. But the challenge is more than simply maintaining or replacing existing structures. The challenge that we face is to meet the future infrastructure needs of a U.S. economy that is undergoing dramatic changes with the restructuring of both manufacturing and service industries and the spatial redistribution of these activities. Results from growing a body of research on infrastructure and economic development reported in this paper underline the importance of maintaining, improving, and expanding public capital stock in order to support future economic growth. Nonetheless, the different circumstances of each region will dictate the types of investment that will be most effective in supporting future economic development.

FOOTNOTES

[1] Households also use transportation services. However, I will reserve this discussion for the next section by thinking about transportation services as augmenting labor productivity by providing an efficient means of getting households to their place of work.

[2] Randall W. Eberts, "Estimating the Contribution of Urban Public Infrastructure to Regional Growth," Working Paper 861O, Federal Reserve Bank of Cleveland, December 1986.

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[4] Jack Tatom, "Should Government Spending on Capital Goods be Raised?" Federal Reserve Bank of St. Louis, mimeo, December 1990.

[5] Kevin T. Deno, "The Effect of Public Capital on U.S. Manufacturing Activity: 1970 to 1978," *Southern Economic Journal*, vol. 55, no. 2, October 1988, pp. 40O-11.

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[11] Saxenian, A. "The Urban Contradictions of Silicon Valley: Regional Growth and the Restructuring of the Semiconductor Industry," in L. Sawer and in. Tabb, *Sunbelt/Snowbelt*, Oxford University Press, Oxford, 1984.

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[13] Randall W. Eberts, "Cross-Sectional Analysis of Public Infrastructure and Regional Productivity Growth," Working Paper No. 9004, Federal Reserve Bank of Cleveland, May 1990.

[14] Fox, William F., and Matthew N. Murray. "Local Public Policies and Interregional Business Development," mimeo, Knoxville, Tenn.: University of Tennessee, June 1988; Bartik, Timothy J. "Business location Decisions in the United States: Estimates of the Effects of Unionization, Taxes, and other Characteristics of States," *Journal of Business and Economic Statistics* vol. 3, no. 1 (January 1985), pp. 14-22; Eberts, Randall in. "Some Empirical Evidence on the Linkage between Public Infrastructure and local Economic Development," in Henry W. Herzog, Jr. and Alan Schlottmann, eds., *Industry Location and Public Policy*, Knoxville, Tenn.: University of Tennessee Press, forthcoming 1991.

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[16] Eberts, Randall in., and Michael Fogarty. "Estimating the Relationship Between local Public and Private Investment," Working Paper 8703, Federal Reserve Bank of Cleveland, May 1987.

[17] Fox, William F. "The Contribution of Infrastructure Investments to Growth: A Review of the Literature," mimeo, University of Tennessee, Knoxville, TN, October 1990.

PREPARED STATEMENT OF DAVID ALAN ASCHAUER

The United States faces major challenges in coming decades. It is imperative that we find ways to deal with many national concerns, among which we find: a persistent drug problem, urban poverty and millions of homeless individuals, a deteriorating environment, a lack of competitiveness in the international economic arena, and the burden of an aging workforce advancing into the retirement years.

Fundamentally, our ability to meet these collective needs will depend on a strong and steady performance by the national economy in the current decade and in the first half of the next century.

Yet, the United States economy has not been performing as well in the past twenty years as in the so-called "golden age" of the 1950's and 1960's. For instance, we have seen a continuing slump in the growth rate of economic productivity, in the annual gains in the amount of output produced by an hour of work effort. Beginning sometime in the early 1970's—the specific point in time 15 not clear—productivity growth fell off by some 1½ percent per year; in the case of labor productivity, from about 3 percent to a much lower 1½ percent per year. This slump in productivity growth is a critical development, for what it implies is that rather than output per laborer doubling once every generation, if the present trend were to continue we can only expect a doubling of productivity once every two to three generations. This slower growth in productivity translates into slower growth in output and in tax revenues, and thereby makes it increasingly difficult to deal with fundamental national problems.

So robust productivity growth would seem to be necessary precondition for innovative public policies. To have a reasonable basis for a hope of success in meeting the variety of national social and environmental challenges facing us, we must first address the needs of the economy. Indeed, it appears we must raise the pace of productivity growth back near the loftier levels maintained in the first two and a half decades after World War II.

But how can we raise productivity growth? It is undeniable that the key to faster productivity growth is investment, both investment in physical capital such as machines and factories, as well as investment in knowledge achieved by spending on research and development, education, and training.

Yet it is also well known that investment has not been particularly robust over the past couple of decades. For example, the growth rate of the net private capital stock has been about 3 percent per year in recent years, down from around 4 percent per year during the 1950's and 1960's. As it turns out, this sluggishness in private capital accumulation is largely the result of a gradual depression in the profit rate on private capital, to about 9 percent from 13 percent during the golden age. Clearly enough, if firms do not see profitability in new capacity, such capacity will not be built.

Of course, there is much controversy about the validity of these facts—slower productivity growth, lower investment, and a falling profit rate. For instance, there are some, like Michael Darby at the Commerce Department, who argue that there has been no true productivity slowdown; instead what we have seen is a merely a "case of statistical myopia." Also, there is much controversy about whether private investment spending really has been depressed during the 1980's—Paul Craig Roberts, for one, emphasizes gross as opposed to net investment and gross investment has been relatively stable in recent years. And others, such as Martin Feldstein and Lawrence Summers—past advisors to Ronald Reagan and Michael Oukakis respectively—insist that there is no long-term downtrend in the corporate profit rate.

Still, it seems clear that the economy has not been doing so well in recent decades. Indeed, the average hourly wage in the private sector, when adjusted for inflation, is now fully 11 percent lower than in 1973. The typical worker in the factories, on the construction sites, and behind the check-out counters increasingly feels the bite as wages barely keep pace with, or even are overwhelmed by, general inflation.

In recent research, several other economists and I have located a partial, yet crucial explanation for the recent poor performance of the United States economy—a partial explanation for our depressed profit rate, for our loin private investment, and for our slumping productivity growth. This explanation is to be found in a falloff in government spending on a "core infrastructure" of highways, bridges, mass transit, water and sewer systems and the other public facilities which comprise what might be called the public foundation for the national economy. Infrastructure and the Economy: Traditional Approach conventionally, spending on public facilities has been thought to have potentially important effects on the economy by creating jobs and stimulating the production of goods and services. An increase in spending on highways, according to the traditional analysis, creates more employment in the construction industry in the first-round and, as construction workers spend their wages, additional second, third, fourth and further-round jobs in other industries. Quoting from an analysis of the effects of highway spending on the New Jersey economy prepared by The Road Information Program (TRIP), "If New Jersey increases its road and bridge improvement funding, it will do far more than just provide smoother, wider, safer roads and bridges. The increased construction activity will generate immediate as well as long-range economic benefits for the Garden State. . . . The construction industry would experience immediate direct benefits, as would the industries that service and supply that industry. But significant effects also would reach into industries outside the construction industry, as workers and companies buy goods and services in the State economy. . . ."

In this approach, sizeable economic impacts of highway and other types of infrastructure spending can be calculated. For example, in the case of New Jersey, as analyzed in the TRIP study, it was estimated that each 100 million dollars of additional highway spending would generate a total of 2,500 extra jobs and $136 million of added goods and services.

While one may argue about the magnitudes of these and similarly calculated effects, the logic of the approach is correct—as far as it goes. But by focusing on the way public expenditures on highways and other public facilities affect the total demand for output, the conventional approach turns a blind eye on the important ways that infrastructure investment affects the total supply of private sector output.

INFRASTRUCTURE AND THE ECONOMY: A NEW APPROACH

An alternative approach to understanding the economic effects of public investments holds that the stock of public infrastructure capital is a critical, though often overlooked, determinant of the economy's ability to supply goods and services to the market. Public capital accumulation, by this reasoning, is just as—arguably, even more—important to the course of material prosperity as is private capital accumulation. In the words of Richard Bartel, editor of *Challenge* magazine, "Investment is the key, as economists know very well, to economic growth and material progress. History records how the creation of physical and human capital drives the wealth of nations. Yet even some economists tend to think of investment in narrow terms—private spending on business plant and equipment. We often forget about additions to the stock of public infrastructure—spending on roads, bridges, mass transportation, airports, waterways, water supply, waste disposal facilities, and other public utilities."

Specifically, one may argue that public capital is an intermediate input to the production process which, by interacting in a complementary fashion with private labor and capital, renders private sector production more profitable and efficient. There are a multitude of ways that infrastructure might influence productivity in such a manner.

First, an improved infrastructure will work to reduce or eliminate production bottlenecks. One clear case would be the efficiency gains arising from the provision of a better transportation infrastructure and the advantages inherent in "just-in-time" inventory management. For instance, over the past half-decade, the Campbell Soup Company has embarked on a just-in-time delivery program for its food production operations and, because rail transportation was regarded to be unreliable, has switched from rail-based to truck-based transportation of its product. At Campbell's Sumpter, North Carolina plant, this combined switch to trucking and just-in-time inventory control has succeeded in reducing inventory holdings by 67 percent and, thereby, afforded considerable cost savings.

And just-in-time is becoming more important in the national production technology. According to one survey, while about 19 percent of nationwide shipments were accomplished in accordance with just-in-time principles in 1987, the survey respondents expected that such shipment volume would rise to over 32 percent by 1995. So while there is the potential for further cost reductions and profit enhancement through just-in-time inventory control, such potential will no doubt remain just that—potential—unless adequate transportation investments are forthcoming in the years ahead.

A second way that an expanded transportation infrastructure can boost productivity is by allowing geographically separate production facilities to be bound together in a single network. This provides the incentive for businesses to adopt "flexible manufacturing" techniques, allowing the firms to shift production from one to another type of product while maintaining nearly the same stock of machinery and factories. By thus providing the capability to respond quickly to shifts in product demand and factor supply, labor and capital resources can be used much more efficiently. Manufacturing costs are lowered, and productivity is increased.

Third, an upgraded transportation infrastructure allows improved access to labor. For instance, a good surface transportation system—roads, light rail, and the like-effectively lets a firm reach further out into the labor pool and results in better matches between Jobs and the holders of various job skills.

Finally, a better infrastructure may allow firms to capture various "economies of scale," efficiency gains arising from larger scale production facilities. For example, due to the existing road network, Coca-Cola Midwest has been able to consolidate all its bottling activity at a larger, more efficient plant in Eagan, MN. The elimination of a number of remote warehouses and move to "rolling warehouses" has allowed Coca-Cola to reap substantial efficiency gains.

For all these reasons and more, an improved infrastructure can boost productivity in the private sector. Indeed, there appears to exist a dynamic interaction between the infrastructure and productivity, a "virtuous cycle" whereby an increase in infrastructure spending raises productivity again and again. In this virtuous cycle, a better stock of infrastructure capital lifts productivity and, by lowering costs and raising profits, promotes private investment. In the course of a few years, this higher private spending on plant and equipment raises productivity still more and, as the higher attained level of productivity then expands the resource base available for even more private investment in factories and machines, the cycle begins anew.

Recent empirical research—my own as well as that of others—suggests that this virtuous cycle was broken during the latter half of the 1960's. Indeed, as the accompanying figure indicates, public expenditure on infrastructure facilities has fallen rather dramatically in the past too decades or so. After rising as a percentage of gross national output during the 1950's and early 1960's, public infrastructure spending peaked at nearly 4 percent of gross output in the late 1960's, only to slide to a low of about 2 percent of output in the early 1980's. As of 1989, infrastructure investment had rebounded to some degree—to 2.2 percent of output—but was still far below the levels attained during the 1960's.

During this same period of time, of course, the labor force continued to grow, placing additional pressure on the available public facilities. Indeed, the fall-off in public investment, as a share of output, is reflected in a similar drop in the amount of public infrastructure capital available to each worker in the private economy. After climbing from around $9,000 (constant 1962) per worker in 1950 to $16,000 per laborer in the early 1970's, the public capital stock had slid to some $14,000 per worker by the end of 1989. At the same time, the amount of private business capital per worker—trucks, machinery, and factories—has continued to climb throughout the post-World War II period, from roughly $16,500 in 1950 to $32,000 by the end of 1989. So while in recent years the private sector has been adding to the capital stock at a faster pace than the labor force has been expanding, the same cannot be said about the public sector. It is in this sense that we may claim that there is a "third deficit" in the national accounts—a deficit just as important and arguably even more important to our economic future as are the budget and trade deficits. Indeed, empirical research indicates that this third deficit, resulting from a shift in government spending priorities away from infrastructure investment, has broken the virtuous cycle of investment and productivity growth and thereby is central to some of our most important long-term economic ills—to our depressed profit rate on private capital, to our overall failure to invest adequately in our future, and to our sluggish productivity growth.

Specifically, the results of this research suggest three broad conclusions about the importance of infrastructure investment to the supply- side of the private economy.

First, a 1 percent increase in the stock of infrastructure capital raises the rate of return to private capital by 1/10th of a percentage point. Loosely speaking, if the government had continued to invest in infrastructure during the 1970's and 1980's at the average pace maintained during the 1950's and 1960's, there would have been less of a "falling rate of profit" in the United States.

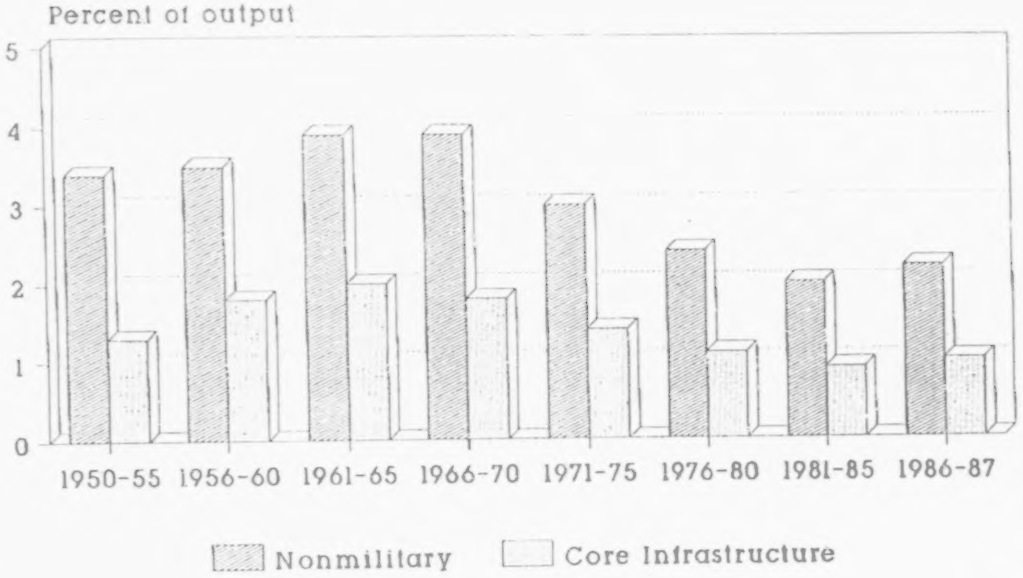
Second, such an increase in public investment spending would have had the net effect of raising the national—private plus public—investment rate during the last two decades, perhaps even back to levels comparable to those of the 1950's and 1960's. At first, private investment in plant and machinery would likely have been depressed due to higher capital goods prices and real, inflation-adjusted interest rates, but over time the positive effect of an upgraded public capital stock on corporate profits would have come to dominate, private investment would have rebounded, and national investment would have been stimulated.

Third, as the national investment rate would then have been higher, productivity growth—annual gains in productive efficiency—would have benefitted. Indeed, the estimates coming out of the State level and national level data indicate that some 15 to 60 percent of the total fall-off in productivity growth in recent decades could be attributed to the neglect of our nation's infrastructure. There is also cross-country evidence which suggests that our relatively low rate of productivity growth—as against, say, that of Japan and West Germany—is partly a result of our relatively low infrastructure investment rate.

CONCLUSION

Of course, the full extent of the relationship between infrastructure spending and the private economy is not completely understood. The research summarized here today is relatively fresh and yet to be fully digested by the economics profession. There are other, well respected economists—such as Henry Aaron and Charles Schultze of the Brookings Institution—who are critical of some of the estimates in the literature. Yet, for the most part, even the critics agree that a bigger share of the nation's current resources should be devoted to public investment in our infrastructure. There is, indeed, a "third deficit" in the American economy, a deficit of inadequate spending on infrastructure. This third deficit deserves Just as much—arguably, even more—attention as does the federal budget deficit in deliberating upon tools to strengthen the domestic economy in the coming years.

Figure 1
Public Investment Trends



Source: Department of Commerce, Bureau of Economic Analysis

[From the Reporter, April 1960]

NEW ROADS AND URBAN CHAOS

(By Daniel P. Moynihan)

THE *Wall Street Journal* does not commonly describe any undertaking of the Eisenhower administration as "A vast program thrown together, imperfectly conceived and grossly mismanaged, and in due course becoming a veritable playground for extravagance, waste and corruption." It must, to the White House, seem notably unkind for the *Journal* to speak thus of an enterprise the administration has declared "the biggest public works program ever undertaken anywhere or at any time throughout the world." But even the President has conceded that all is not well with the $15-billion Interstate and Defense Highway program.

The program provides for the construction of 41,000 miles of superhighway, connecting ninety percent of the nearly three hundred cities of the continental United States with populations of 50,000 or more. When completed, the system will carry 20 percent of the nation's traffic. Up to 95 percent of the cost will be paid by the Federal Government. Half of it will be spent in the cities the system connects.

Washington abounds with administration task forces, Congressional committees, and special-interest groups—all investigating this program. Those in Congress who are looking for scandal will likely find no end of it. Those in the President's office looking for ways to cut back the program will have an even easier task, although they may encounter more difficulty getting their findings published during this election year. But very few seem to be asking whether, quite apart from corruption or extravagance, the program is bringing about changes for the worse in the efficiency of our transportation system and the character of our cities.

One of the best-publicized resolves of the administration that took office in 1953 was to redress the balance of Federal-State relations by divesting the National Government of such usurpations of State sovereignty as vocational education and aid to the dependent blind. While almost nothing has come of this endeavor, an important change in Federal-State relations has in fact taken place during the Eisenhower years. The Federal Government through the Federal Aid Highway Act of 1956, has assumed the direction of highway construction—one of the few areas of significant government activity in which the States still had the initiative after the New Deal.

Although the Federal Government has been providing some highway aid to the States since 1916, road building was almost entirely a State and local affair until 1956. The Federal Bureau of Public Roads was, as late as 1939, a small agency in the Department of Agriculture helping to "get the farmer out of the mud" by supplementing State highway budgets. The States spent the money pretty much as they pleased.

The system was permissive but not disorganized. Standards for highway construction, for example, and national routes (the familiar US sign) were successfully established on a voluntary basis. For the most part, however, these roads followed trails that had originated far back in frontier history. With the coming of the automobile they were just surfaced, and widened and straightened somewhat. Our counterparts of the "rolling English drunkard" who laid out Chesterton's "rolling English road" were the Iroguois war party and the Conestoga wagon: more purposeful but not less circuitous as they sought out the passes and water-level routes north and south, and across the continent. The Roman roads Hilaire Belloc has written of, struck like a lash across the conquered provinces, were not reproduced in America until we too established a dominant central government.

The idea of a Federal system of superhighways arose during the First World War. It was revived by the Roosevelt administration as a public-works project for building 14,000 miles of transcontinental routes. A study made by the Bureau of Public Roads, which the President commended to Congress in 1939, revealed that there was surprisingly little cross-country traffic and suggested that the concept be changed to a 26,700-mile intercity system. The idea was popularized by General Motors' Futurama exhibit at the New York World's Fair.

In 1944, after some further study, Congress authorized construction of a National Interstate Highway system on this basis. The size was increased to 40,000 miles. Thus, from the outset there has been more mileage authorized for the system than anyone knew exactly what to do with.

MORE ROADS FOR MORE CARS

Authorization is the first step in a Federal public-works program. It more or less commits Congress to appropriate money at a future date and provides time for plans and other necessary arrangements to be made. Plans for the interstate system went ahead. In 1947 the Federal Government and the States agreed on the location of 37,700 miles of the system, leaving the rest for additional urban connections. The roads were to be limited-access, multilane high-speed routes designed to the highest standards. But no special funds were appropriated to build them; only regular Federal highway-aid funds were made available, on the standard fifty-fifty matching basis. This required the States to take sizable amounts of money from regular projects to spend on interstate mileage.

The result was that the interstate mileage didn't get built. Highway-construction expenditure multiplied by nearly eight times from 1945 to 1952, but the States just wouldn't use their money on interstate highways. It had never, after all, been their idea. Special funds were thereupon appropriated and the Federal share increased to 60 percent, but still with little effect. By 1952, less than 1 percent of the system had been completed. Three years later President Eisenhower declared: "At the current rate of development, the interstate network would not reach even a reasonable level of extent and efficiency in half a century."

For the highway transportation industry this raised a serious question. Automobile registrations had almost doubled in the first decade afterthe war. By 1955 there was a motor vehicle for every 700 feet of lane in both directions on all the streets and roads of the nation. It was expected that registrations would rise another 40 percent in the following decade, to a total of 81 million. Yet, already the cities were chockablock with cars. Unless more room was made for automobiles, the automobile industry itself might feel the pinch. "Either the roads must be made adequate for the traffic," stated the *Engineering News-Record*, "or the end of national expansion as we know it must be accepted."

Few pains were spared to popularize this notion. General Motors even went into the essay-sponsoring business, offering $25,000 for the best theme on "How to Build the Roads We Need." (The prize was won, naturally, by Robert Moses.)

But the Eisenhower administration needed little persuading. Highway transport had become, in the words of the Brookings Institution, "the greatest single combination of economic activities in men's history."

In July, 1954, the President proposed a "grand plan" for a national highway system. His plan was to build the interstate system Roosevelt had proposed and Congress had authorized. He next appointed a committee composed of General Lucius D. Clay and assorted men of substance, including Dave Beck, as was *de rugueyr* in those days, to devise means for doing so. The committee quickly reported that the system would cost only $27.5 billion, and could be built, with borrowed money, in 10 years. It proposed thatthe Federal Government pay 90 percent of the cost generally and up to 95 percent in States with extensive untaxed Federal landholdings. The President submitted this proposal to Congress in February, 1955.

SOMETHING FOR EVERYBODY

Introducing a highway program in today's Congress is like letting a tariff bill loose in the old days: the figures go up and up and up. The economic interest in highways affects not only General Motors but also countless numbers of garage owners, automobile dealers, road contractors, real-estate developers, and similar large and small businesses throughout the land. Conservatives think of roads as good for business. Liberals think of them as part of the litany of public investment they so love to chant: "Better Schools . . " Plain politicians think of roads as the indispensable means by which the owners of 70 million motor vehicles derive the benefits from what is for most of them the largest or second largest investment they ever make.

Highway construction is especially important to the professional politicians, since it provides the largest single supply of money available these days to support their activities. The alliance of the county leader and the contractor is ancient and by no means dishonorable. Public works represents the most beneficent outlet yet devised for the politician's need to make a living and at the same time please the public. If it occasionally takes the form of paving stream beds in Kansas City, it may also produce a New York State Thruway.

In most States a symbiotic relationship has been established between the contracting firms and the local political organizations which obviates the usual forms of corruption. The contractors pay an honest tithe to the parties' exchequers out of fair profits, which are large mostly because the sums involved are vast. It is a point of pride with many contractors to make all contributions by check and often, as it were, in public through advertisements in party yearbooks. To the extent that this system works, it provides an excellent if informal means of financing our parties out of tax funds: contractors are normally apolitical, asking only that there be just a little more than enough work to go around. The politicians usually do their best..

One special attraction of the interstate program was that these roads, for the most part, would be brand-new. Seventy-two percent of the mileage, both in urban and rural areas, would be on entirely new locations. Along most of these 30,000-odd miles, property values are destined to soar. This is sure to please the owners, whether the property has been in the family for years or, by good fortune, recently acquired. The redoubtable George Washington Plunkett of Tammany Hall was not the last American politician who could suggest as high epitaph "He Seen His Opportunities, and He Took 'Em."

In a Democratic Congress dominated by Southern and Western representatives, the program had the further advantage of providing a considerable subsidy to those parts of the country. Far the heaviest concentration of traffic and automobiles in the nation is located in a parallelogram running from Boston to Milwaukee down to St. Louis over to Washington and back up to Boston. The area's fourteen States and the District of columbia had just under half the nation's motor vehicles in 1955. However, only a quarter of the interstate mileage is located in these States. Mississippi, with one-third to a half as many automobiles as Massachusetts, is to get almost one and one-half times the mileage. Texas, with five-sixths as many automobiles as New York, is to get almost three times as much mileage.

It was fortunate for the President that there were so many sound political reasons to support his program. There weren't many others. With the railroads running at 50 percent of capacity, a sudden, sharp increase in intercity transportation facilities represented, if anything, a threat to the economic stability of the entire transportation indsutry. Amost certainly the 40,000-mile figure was too large: it had no basis other than the enthusiasm of the wartime Congress for a peacetime program that might be years away. In 1944 Congress had little idea where this mileage was to be located, much less whether it would be needed... Ten years later the Clay Committee appointed by President Eisenhower found that only 8,500 miles of the system could expect enough traffic to pay for themselves as toll roads—and of these, all but 3,500 were already built or being built.

There was no question that city streets were jammed, and it was always understood that half the cost of the program would go to urban arterials. But this aspect of the program should have evoked the Malthusian specter raised by New York City's Deputy Administrator Lyle C. Fitch: the number of automobiles increases to fill all the space provided.

A few months after the program was adopted, Geoffrey Crowther of the London *Economist*, returned from a trans-American tour, told a New York meeting of the Committee for Economic Development: "I have driven myself with my own hands over 12,000 miles. . . . I could tell you a great deal about the . . . fabulous development of the highways in the United States. I find myself puzzled by the statements—that are taken for granted in this country now—that your highways are obsolete. I think I can claim to know as much about them now as anybody in this room and I say it is not so. Your highway system is magnificent. It is overburdened in the immediate vicinity of the large cities, but get away from the large cities and your highways are empty.

"I wonder," said Crowther, speaking of the new interstate program, "if the matter has been investigated as thoroughly as it should be." It had been. Any number of Congressmen had wondered if it could not be made bigger. It was. The President's proposal was adopted with only one other important change. Ever alert to the call of patriotism, Congress lengthened the title to make it the Interstate *and Defense* Highway program.

WHO PAYS THE BILL?

The urge to have the highways was not matched by an urge to pay for them. From the outset the financing of the program has been the object of much controversy and muddle.

The Clay Committee had proposed that the program be financed through an independent Federal Highway Corporation which would sell some $20 billion worth of bonds to raise money to build the highways in a 10-year period. The bonds would be retired over 30 years by the returns on the 2-cent Federal gasoline tax. This would have permitted an increase in government borrowing and spending of billions of dollars each year, without any increase in the debt limit, the budget, or taxes.

The fiscal conservatives in Congress were upset by this proposal for deficit financing. The partisan Democrats were loath to let the President carry off such a political coup. The two groups combined to insist on what is substantially a pay-as-you-go program, matching increased expenditures with increased taxes. After some difficulty over which taxes would be increased, a bipartisan program passed the House in April, 1956, by a vote of 388-19. The Senate approved its measure and the president promptly signed the conference bill.

The Highway Act of 1956 gave the President the $25 billion he had asked to construct the interstate system (to be matched by $2.5 billion from the States) and provided a third more than he had asked for regular highway aid. The authorized mileage of the interstate system was increased to 41,000. It was to be built over a 13-year period, at a rate of Federal expenditure rising to $2.2 billion per year.

To provide the money, the fuel tax was increased from 2 cents to 3 cents per gallon and the tax on new tires from 5 cents to 8 cents per pound. These increases, together with some smaller ones on other taxes, brought an increase of almost two-thirds in taxes on highway use. A Highway Trust Fund was set up to receive these and some related taxes. The receipts of the Trust Fund would be used to pay for the highway program.

The device of the Trust Fund satisfied the administration's wish to keep the increased level of government spending from showing up in the budget. The bulk of highway expenditure is now carried as a separate item, similar to Social Security payments. Thus, in the budget for fiscal year 1961, highway expenditures are shown as $3 million, although they will actually be something like $3 billion.

The program got underway on July 1, 1956, but it was in trouble even before it began. The financial plan provided for the Highway Trust Fund to incur some deficits during the peak construction years. These would be balanced by surpluses obtained during the early period when the program was still on the drawing boards and during the latter years as it was tapering off. At the last minute, Senator Harry Byrd of Virginia, supported by Secretary of the Trasury George M. Humphrey, added an amendment that forbade the Trust Fund ever to incur a deficit. This meant the scheduled program would have to be cut back as soon as the small initial surplus was used up.

A deficit seemed imminent in March, 1958, when the President asked Congress to permit the expenditure of an additional $600 million on the interstate system as an anti-recession measure. Congress eagerly responded with $800 million. The 1958 recession thus caused an increase in expenditures and at the same time a decrease in receipts because of lowered economic activity. In January, 1959, the Secretary of Commerce reported to Congress that unless receipts were increased the fund would soon be exhausted. There would be no interstate funds apportioned for fiscal year 1961 and only $500 million for 1962.

To prevent this the President asked that fuel taxes be increased from 3 cents to 4½ cents a gallon. This aroused opposition from the oil companies, and for a time it seemed that the program might be seriously interrupted, but at the last moment Congress enacted a 1-cent gas-tax increase. The President asked for the other ½ cent in his recent budget message, but nothing will be done until after the election.

Something will have to be done soon, however, for the financial problems of the interstate system have become more difficult than simply maintaining the level of expenditures envisioned in 1956. Since then the estimated cost of the system has almost doubled.

In January, 1958, the Secretary of Commerce announced that revised estimates indicated that instead of $25 billion, the Federal share of the interstate cost would be nearly $34 billion. This was for only 38,548 miles, however, which, it turned out, was all the routes laid out in 1947 required. To build the remaining 1,452 of the 40,000 miles originally planned (never any question of just dispensing with them as a tribute to efficient management) and the extra 1,000 miles authorized in 1956 will require another $2.2 billion. Technically, the revised estimate did not even cover all of the 38,548 miles, since it did not include the cost of reimbursing the States that had already built parts of the system with their own funds or as toll roads. This would add perhaps $4.3 billion. There is also the matter of some $1.5 billion for relocating railroad tracks, telephone lines, and other utilities disturbed by the new highways, as authorized by Congress. Also, another $0.5 billion might be needed to provide the extra 1.5 percent of the cost to States that forbid billboards along the new routes, as authorized by Congress. This could bring the total Federal-State cost to something like $45 billion. The sole prospect of economy is that the States aren't taking up the no-billboard option.

WHO RUNS IT?

This is not the end of it: rising costs are built into the interstate system. From the ouset the program has been undermined by the Administration's desire for Big Government achievements without Big Government. The Clay Committee envisioned the largest public-works program in history being carried on with no increase in public personnel. ". . . The Federal Highway Corporation should consist only of a board of directors with secretarial assistants"—a kind of bureaucratic fantasy in which almost everyone is a member of the board and there is no overhead. The Clay Committee proposed that the interstate program be operated through the Bureau of Public Roads as an ordinary Federal highway-aid program, with all the work of picking sites, drawing plans, letting contracts, and so forth, done by the States. For extra help the States, many of which were altogether incapable of doing such work anyway, would turn to the "private engineering organizations capable of providing sound engineering in this field." All of this, in some way, would further "the President's stated desire for 'a cooperative alliance between Federal Government and the States so that government . . . will be the manager of its own area.'"

The President has had his desire. The Bureau of Public Roads, with only a handful of extra help, depends on the States, which depend on the consulting engineers. The consulting engineers, normally paid by a percentage of cost of the projects they design, depend on the Rotary Club for forecasts of the traffic potential of whatever town they happen tc be tearing up.

WHERE IS IT BUILT?

Many instances of almost incredible mismanagement have appeared in scathing reports by the Comptoller General, but there is nothing to be done about it. The interstate program is not a Federal enterprise; it is only a Federal expense. Washington is simply committed to keep supplying money until it is finished. But the States have no real freedom of action either. The basic decision to build the system has been made for them: the enormous "bargain" of the 90-10 money makes it politically impossible to do anything but take the money as fast as possible and try to match it. Since all contracts are closely scrutinized by the U.S. Bureau of Public Roads, the States hardly see it as their responsibility to control the costs of the program, as indeed it is no. But the bureau, under equally heavy pressure to keep the program rolling and Congress happy, exercises little real control. It functions rather as a company comptroller who fusses over items on an expense account without ever daring to ask if the trip was necessary. In fairness, the bureau could harly do otherwise: in 1958 it had two investigators to cover the entire United States..

The Comptroller General's men recently came upon a three-mile segment in "a very sparsely settled area" of Nevada on which three interchanges have been built at a cost of $384,000. They will handle a daily traffic load of 89 vehicles, serving, in the words of the General Accounting Office, "some old mines, a power line, four or five small ranches, and a house of ill repute."

From Arkansas the State auditors reported: "On every hand among both employees and commissioners we encountered a strange and distressing apathy at any extravagant use of highway funds." In Indiana apathy was replaced by enthusiasm: the boys had organized a syndicate with highway-department employees to take *all* the risks out of speculating on capital gains from right-of-way condemnations. The Pennsylvania highway department, 100 percent patronage, was performing less than 10 percent of the preliminary engineering on interstate routes, while passing out contracts to consulting engineers at the rate of $1 million a month. In West Virginia, ". . . only about 10 percent of the State's project engineers . . . were registered or graduate engineers."

With no strong direction of the program, there has been no way to resist the political pressures to build a little bit of interstate highway in every county along the 41,000-mile route. Limited-access highways over new locations are more like bridges than ordinary roads. Until they make the complete crossing from one city to another they are relatively useless, starting, likely as not, at one of the cities and ending in a cornfield. A minimum of businesslike management would have arranged for the system to be built in complete segments, concentrating on the more important ones. Instead it is being built in fragments strewn across the continent. It will be years before these are connected into anything like a national system.

The repeated financial crises of the program have created a mistaken impression that it is slowing down. Apportionments of funds for the next two fiscal years will be down as much as $600 million, but this will no more than offset the increases provided in 1958. According to Federal Highway Administrator Bertram D. Tallamy, who built the New York State Thruway and is in charge of the interstate program, expenditures are running some 4 percent ahead of the schedule envisioned by the 1956 legislation. Fifteen thousand miles of the system are either in the contract stage or have actually been completed. Routes have been located and plans are in process for 95 percentof the remaining mileage.

True, unless more funds are made available, the program will stretch out. But there is much support for providing more funds. The President's recent budget message, which calls for cuts in housing, hospital, water pollution, and similar programs and makes clear that a serious education bill will be vetoed, nonetheless proposes more funds to "permit the construction program for the Interstate System to proceed at a higher and more desirable level." Congress continues to share the President' unflagging interest in highways. Senator Albert Gore, who sponsored the 1956 legislation, was talking awhile back about adding another 7,000 miles.

A few legislators such as Senator Paul Douglas of Illinois have questioned whether this is the very best way to spend our money. Senator Eugene McCarthy of Minnesota has asked whether the program wasn't merely hastenning the day when "You'll be able to drive 80 miles an hour along superhighways from one polluted stream to another, from one rundown college campus to another."

The only certain consequence of the rising costs of the program is that there is no longer much serious possibility of reimbursing the States that built sections of the system as toll roads. In the postwar years, after the outlines of the interstate system had been established, a number of States did this. From the outset of the present program it has been recognized that justice entitled these States to be reimbursed so that they might either remove the tolls or build additional roads. Five years ago it seemed unthinkable that this would not be done. An administration spokesman told the House Committee on Public Works that not to reimburse these States would be like saying, "Boys, we are sorry, you took care of yourselves, so you do not get anything."

The 1956 legislation declared the intent of Congress to settle this matter, but as one financial crisis has followed another, the intention has grown weaker. It is now practically settled that those States which did not wait around for Uncle Sam to look after them will in fact get nothing. So much for the fate of the bird dogs in the Eisenhower years.

Not surprisingly, 70 percent of these toll roads are located in the States of the northeastern parallelogram, which as a result will get even less than a quarter of the interstate mileage.

This development only compounds the inequity of paying for the interstate system with gasoline taxes. Drivers on the Massachusetts Turnpike, the Indiana Toll Road, the New York State Thruway, and similar highways will not only have to pay tolls to use their portion of the interstate system, but they will be paying extra gasoline taxes to build the other portions.

WHO BENEFITS MOST?

Apart from any regional imbalance, the gasoline tax is still a highly questionable way of distributing the burden of paying for the interstate system in terms of the benefits that will be derived from it. The fuel levy really amounts to a household tax—more than $15 a year on the average—on the 7 out of 10 American families that own an automobile. Most of these families will use the interstate from time to time, but hardly enough to get their money back.

By contrast, the system will provide a great subsidy to industry in the form of cheap road transport. The nature of this subsidy has been obscured by the endless arguments concerning the precise share of highway costs that should be paid by trucks as against private automobiles. (The Federal Government and the States are currently spending $22 million running tractor-trailers over a road near Ottawa, Illinois, to determine just how much they damage the pavement.) Although it appears that truckers do not pay a fair portion of highway costs, this in itself is not the secret of their economic success. The truckers' main advantage is that railroadsmust pay *all* of the cost of building and maintaining their transportation system, while trucks pay only when they actually use the roads. Of each railroad revenue dollar, 20 cents goes to right-of-way costs. For trucks the figure is 4½ cents.

As a result of this advantage, in the words of the industry's trade association, "Within one generation, trucking has become the dominant form of transportation in the United States." This dominance will be confirmed by the completion of the interstate system, at a presently estimated cost of some $45 billion. The net investment in our entire 220,000-mile railroad system is only $28 billion. Were it not for the trucking subsidy, the railroads would almost certainly be running at better than their current 50 percent of capacity.

Some of this imbalance could be righted if the Interstate Commerce Commission were authorized to take the road subsidy into account in fixing trucking rates. But actually, only a third of the road transport is conducted by firms operating as common carriers in direct competition with railroads and under regulation by the ICC. Railroad analyst A. Joseph Debe of Standard & Poor's estimates that two-thirds of it is conducted by or for private industries hauling their own products. It is these companies, spread across the entire range of American industry, that benefit most from the highway subsidy.

Because two-thirds of truck traffic is subject to no rate regulation, the only practical way to restore any economic balance in intercity transportation would be to impose a toll on the commercial users of the interstate system. A permit system would not send trucks to parallel routes: they gladly pay as much as 10 cents a mile to use a road like the New York State Thruway. (This may give some indication of the size of subsidy on free roads.)

The question of tolls must also be asked in connection with the problem of how the system is to be maintained by the States once it is built. Running a limited-access highway is a complex, exacting job requiring intensive, continuous supervision, much as does running a railroad. The great turnpikes are, in fact, very much like railroads; they are not public facilities nearly so much as they are public enterprises. Their headquarters are elaborate communications centers receiving information and dispatching orders, often of much urgency. The forces required to keep the routes open in winter, repair damage, keep up with maintenance, and generally look after things are far greater than those required on ordinary roads. The costs run as high as $10,000 per mile per year. Few States have this kind of money; fewer have the organization to spend it effectively. Only tolls can really be expected to provide either.

The problem will be vastly enlarged by the absence of any food or fuel facilities on the interstate system. Limited-access highways are isolated travel corridors; it is essential that they be as self-contained as possible. Restaurants and service stations are automatically included in plans for any large toll road. Anyone who has used a turnpike knows how busy these facilities are. They produce income from concessionaire fees and provide indispensable services to motorists. But the Highway Act of 1956 specifically rovided that there should be *no* service facilities on the system.

A motorist on the interstate system who has car trouble or needs gas will have to leave the main road at an interchange to find a service station. At four in the afternoon he will almost certainly fine one open. At four in the morning he will almost certainly find them all closed. The oil companies are thus free of any obligation to set up stations on interstate routes where their prices might be regulated, where they might have to share their profits with the State Governments, and most particularly where they might have to stay open in the unprofitable hours of the early morning. And, of course, nothing will help real-estate values at those interchanges like a gas station and a honky-tonk or two. As far as the public is concerned, it means the interstate routes will almost certainly be poorly maintained and will be dangerous to drive on at night or at any time during the winter.

CHAOS IN CONCRETE

It isnot true, as is sometimes alleged, that the sponsors of the interstate program ignored the consequences it would have in the cities. Nor did they simply acquiesce in them. They exulted in them. Thanks to highways, declared the Clay Report, "We have been able to disperse our factories, our stores, our people; in short, to create a revolution in living habits. Our cities have spread into suburbs, dependent on the automobile for their existence. The automobile has restored a way of life in which the individual may live in a friendly neighborhood, ithas brought city and country closer together, it has made us one country and a united people."

This rhapsody startled many of those who have been concerned with the future of the American city. To undertake a vast program of urban highway construction with no thought for other forms of transportation seemed lunatic.

The 1939 report that Roosevelt sent to Congress—prepared in the Department of Agriculture—took it as axiomatic that the new highways would be part of, and provide the occasion for, a "radical revision of the city plan," which would coordinate other urban programs such as slum clearance and provide for a "reintegration of facilities for the various forms of transportation." The 1944 legislation had much the same intent. But so far as the Highway Act of 1956 goes, there is no form of transportation but the automobile, and the act has no objective save providing more room for it.

It had always been understood that a large portion of the interstate funds would be spent in the metropolitan areas, but the 1956 legislation went further to declare that "local needs . . . shall be given equal consideration with the needs of interstate commerce," thus authorizing construction of arterial highways only be courtesy connected with the interstate system.

It was clear at the time that locating the metropolitan portions of the interstate system would constitute an unprecedented venture into nationall planning. It was estimated that the size of our metropolitan areas would double by 1975. For good or ill, the location of the interstate arterials would, more than any other factor, determine how this growth would take place. Yet no planning provisions of any kind were included.

In the absence of any other provisions, the "planning" would be done by highway engineers. Theirs, admittedly, is an unjustly maligned profession. Nothing in the training or education of most civil engineers prepares them to do anything more than build sound highways cheaply. In the course of doing this job they frequently produce works of startling beauty—compare the design of public highways with that of public housing. Yet, in the words of John T. Howard of the Massachusetts Institute of Technology, "It does not belittle them to say that, just as war is too important to leave to the generals, so highways are too important to leave to the highway engineers."

Highways determine land use, which is another way of saying they settle the future of the areas in which they are built. It stands to reason that engineers should be required to conform their highway plans to metropolitan land-use plans designed in the context of more general economic and social objectives.

Yet, in 1956, we had no metropolitan area plans, as we had no metropolitan area governments. The only one we have now is in Dade County (Miami), Florida, which is just getting started.

In this predicament, there was considerable sentiment for a moratorium on the urban interstate program until planning requirements could be imposed. Most of those concerned, however, as the distinguished transportation economist Wilfred Owen is frank to say, felt if the program went ahead it would precipitate such a crisis that something would have to be done at last about our metropolitan areas.

Across the nation there seemed to be an increasing awareness among those who actually run the cities and suburbs that to do nothing more than build bigger highways only produced bigger traffic jams. There seemed a growing belief that a complex system of mass transit had to be preserved, or revived, or even indeed created—if only to make automobile transportation feasible.

The sorry results of carrying on a number of Federal urban-development programs completely independent of each other had become increasingly evident. Thus, the American Municipal Association formally requested legislation requiring that the urban-renewal and highway program be coordinated.

The crisis has come. It has been impossible for the cities to resist the offer of unprecedented amounts of money, however futile they might know it will be to spend it on highways alone. In one metropolis after another the plans have been thrown together and the bulldozers set to work.

Here and there, as in Milwaukee, a vigorous and established city planning authority has been able to get intolerable plans redrawn. But, in general, the program is doing about what was to be expected: throwing up a Chinese wall across Wilmington, driving educational institutions out of downtown Louisville, plowing through the center of Reno. When the interstate runs into a place like Newburgh, New York, the wrekage is something to see. Down the Hudson, Robert Moses is getting set to build the Canal Street Expressway, the first $100-million mile.

The Bureau of Public Roads recently considered an edict requiring that some area plans be developed before interstate funds are allocated, but the idea was abandoned. Some felt it was too late anyway. As for relating the highway program to urban renewal, a recent policy statement of the American Institute of Planners said simply: "Except for the coordination which may be supplied at the local level . . . each one is apparently operating entirely independently of the other." The legislation asked by the Municipal Association was never introduced. It was with compassion that Paul Ylvisaker of the Ford Foundation recently addressed a meeting of city planners as the "Beaten Profession."

Just ahead for all of us, perhaps, is Los Angeles, in the words of Harrison Salisbury, "nestled under its blanket of smog, girdled by bands of freeways, it core eviscerated by concrete strips and asphalt fields, its circulatory arteries pumping away without focus . . . the prototype of Gasopolis, the rubber-wheeled living region of the future."

MONEY TALKS

Yet we may be learning out lesson after all: Owen may be right. All across the country, area planners and highway engineers are discussing what they recognize as their common problems with a new sense of urgency. It is clear that if the areas in which Federal highways are to be built were required to work out adequate plans for the use of land and transportation before the money was handed over, the planning would almost certainly be done. The demand for 90–10 highway funds is so great that there is almost nothing, however sensible, that local governments would not do to get their share.

It is true that metropolitan-area planning will not be an easy matter to bring off. Dennis O'Harrow, director of the American Society of Planning Officials, says candidly: "There is a shortage of planners, a shortage of information, a shortage of money to support studies, and more fundamentally, a shortage of information as to what should be done if you could do what you wished." But this is a normal condition of human affairs. Almost any effort to think a bit about what we are doing would help.

Simply by providing some flexibility in the program, we could produce great savings. If the cities were permitted to do what they thought best with say, 50 percent of the more than $20 billion of interstate funds allotted to them, much of it would almost certainly go to mass transit and commuter facilities. This kind of money could reshape urban transportation in America: our total national investment in public transit is less than $4 billion, and a combined highway-mass transit-commuter program could almost certainly produce the same results at lower cost than a program dependent on highways alone.

It is becoming increasingly apparent that American government, both national and local, can no longer ignore what is happening as the suburbs eat endlessly into the countryside. Since the spreading pollution of land follows the roads, those who build the roads must also recognize their responsibility for the consequences. There are a number of obvious steps that could be taken. Public authorities could, for example, buy up the development rights of open land in the suburbs—not the property itself, but only an easement to prevent it from being turned into a factory site or a housing development. This could be done, as it is in England, in accordance with an area land-use plan that fixes the perimeter of the metropolitan area, or alternates built-up sections with open spaces. What this really amounts to is effective zoning regulations.

How could the money be found to pay for the development rights? A practical solution would be the technique of "excess-taking" as proposed by President Roosevelt in his 1939 message to Congress. As he put it: "The government, which puts up the cost of the highway, buys a strip on each side of the highway itself, uses it for the rental of concessions and sells it off over a period of years to home builders and others who wish to live near a main artery of travel. Thus the government gets the unearned increment and reimburses itself in large part for the building of the road."

This "unearned increment" can be staggering: a 5,000 percent increase in land values is not uncommon. At a time when State and local governments are reaching a limit of the money they can get out of taxpayers, here is an opportunity to get money that doesn't belong to anyone: it doesn't exist, as it were, until the government builds the highway. It represents a legitimate source of government revenue of great potential. Used to shape the development that the highways make possible, it could transform the suburbs of the next half century.

All these possibilities are enlivened by the investigation of the interstate program now getting underway in Congress. So much thieving, mischief, and blunder will be uncovered (if not, it will be necessary to investigate the investigators) that the public should be prepared for a serious reappraisal of the program by the next administration, Democratic or Republican.

We may yet impart some sanity and public purpose to this vast enterprise. We may yet establish some equity in paying for the highways and restore some balance between them and other elements of our transportation system. We may even refute Belloc's dictum, "The general rule in history is that a city having reached its highest point of wealth becomes congested, refuses to accept its only remedy, and passes on from congestion to decay." But we shall not escape his rule that "the Road moves and controls all history."

Roads can make or break a nation.

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